# PIT AND QUARRY

OCT 1 6 1936

JULY, 1936

Cowell Cement's new electrical-precipitation equipment . . . Lehigh modernizes Fordwick plant . . . Santa Cruz loading, water-shipping and coastwise distributing system . . . The lime-saturation index of Portland cement

TN1
P65

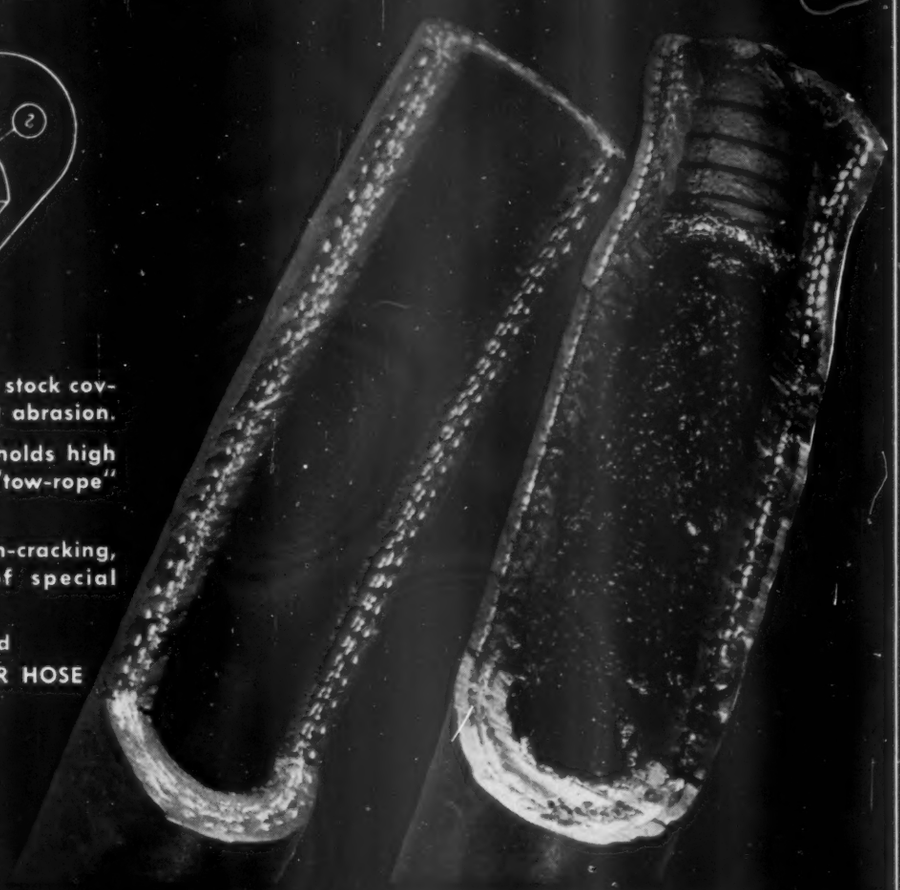
# WHICH WOULD YOU BUY?

1 Heavy super-tough tire stock cover that resists severest abrasion.

2 Braided Carcass that holds high pressures and absorbs "tow-rope" strains.

3 Thick, slow-ageing, non-cracking, oil-resisting tube of special Goodyear compound.

G.T.M.-specified
GOODYEAR CORD AIR HOSE



This unretouched photograph shows you how Goodyear Air Hose (left) compares with other makes after the same length of service under identical conditions. Note that the tube of the Goodyear Hose shows practically no deterioration from oil—whereas the other is deeply rotted and flaking badly! This slow-ageing, non-cracking, oil-resisting tube—an exclusive development of the world's largest rubber manufacturer—explains why Goodyear Air Hose gives so much longer and lower cost service without clogging tools!

*This service-proved construction is embodied in all five brands of Goodyear Air Hose for every type of service. For further data write Goodyear, Akron, Ohio, or Los Angeles, California — or the nearest Goodyear Mechanical Rubber Goods Distributor.*

**BELTS**
**MOLDED GOODS**
**HOSE**
**PACKING**

THE GREATEST NAME IN RUBBER

**GOODYEAR**

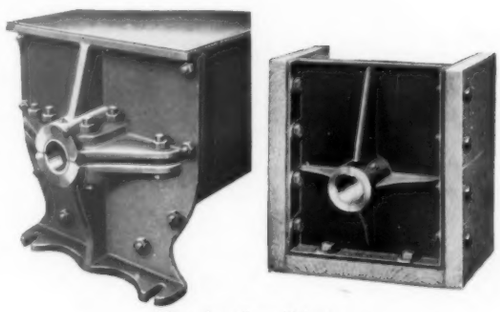
PIT AND QUARRY, July, 1936, Vol. 29, No. 1. Published monthly by the Complete Service Publishing Company, 538 South Clark Street, Chicago, Ill. Subscription price: $2 for 3 years, $1 for 1 year in the U. S. and possessions, Canada, and Central and South America; elsewhere $1 additional for each year. Single copies 20 cents. Entered as second-class matter November 28, 1932, at the Post-Office at Chicago, Ill., under the Act of March 3, 1879.

# CONVEYING EQUIPMENT BY LINK-BELT

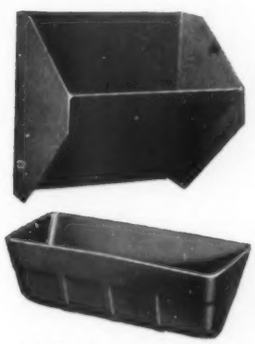
Caldwell-Moore Sectional Flight Conveyor. It is easy to renew, and is obtainable in odd diameters and pitches, or with screw of unusual size.

Complete line of anti-friction belt conveyor idlers and other belt conveyor equipment.

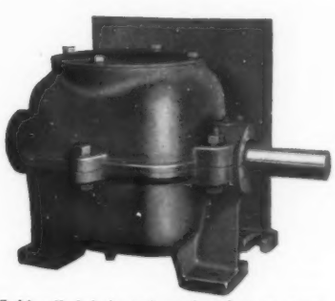
● Use genuine Link-Belt elevator, conveyor and power transmission replacements, and be sure of dependable performance and long life. The Link-Belt line is complete. Send for 1024-page General Catalog, Engineering Data Book No. 600. Address the nearest office.



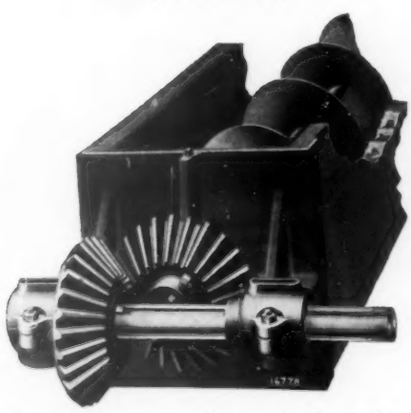
Trough ends—all types.



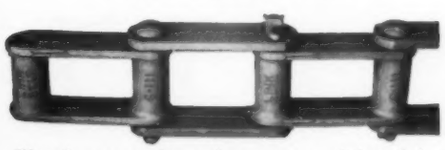
Link-Belt elevator buckets for durability and low-cost service.



Caldwell lubricated enclosed gear countershaft ends.

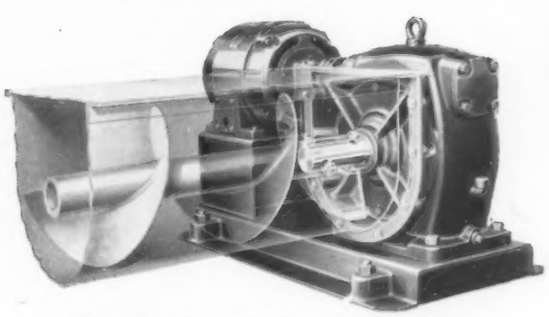


Standard countershaft trough ends. Can be furnished for wood or steel trough.



Elevating, conveying and power transmitting chains made of malleable iron, Promal and steel.

Hangers for steel or wood trough.



Caldwell standardized drive. A modern, self-contained drive for 6″ to 20″ screw conveyor.

Standard sizes of Caldwell steel U-trough from 6″ to 16″ inc., are assembled with malleable iron end flanges, welded to trough sheets, as shown. Malleable iron flanges are practically unbreakable. Flanges can be furnished with or without feet.

## LINK-BELT COMPANY

The Leading Manufacturer of Equipment for Handling Materials and Transmitting Power

CHICAGO Plant, 300 W. Pershing Rd. CHICAGO, Caldwell-Moore Plant, 2410 W. 18th St. ● INDIANAPOLIS, Ewart Plant, 220 S. Belmont Ave.
PHILADELPHIA Plant, 2045 W. Hunting Park Ave. INDIANAPOLIS, Dodge Plant, 519 N. Holmes Ave. SAN FRANCISCO Plant, 400 Paul Ave.
ATLANTA Plant, 1116 Murphy Ave., S. W. *Offices in Principal Cities* In Canada—Link-Belt Limited—Toronto Plant; Montreal; Vancouver.

# REPUBLIC

# TOWER

## PNEUMATIC HOSE

★ Through field experience and extensive laboratory research, Republic has developed an air hose that successfully combats the destructive influences of oil, heat, high pressures and the severe abrasive action of sharp rock and coal. It is built for most rugged use in mines, quarries, rock industries, construction and general industrial applications.

The tube has the utmost resistance to oil and heat, being made of a special compound similar to that used in oil conducting hose. The braided plies are composed of specially twisted cords, which give strength without impairing flexibility. The cover is designed for extreme wear and exposure to sun and weather. It is made from an unusually high grade compound that has great resistance to abrasion, cutting action, shock and abuse.

All construction details of Tower Hose have been so balanced and engineered as to result in a hose of great strength without excess bulk or useless weight.

**THE REPUBLIC RUBBER CO. «» YOUNGSTOWN, OHIO**

MECHANICAL RUBBER PRODUCTS FOR EVERY INDUSTRIAL REQUIREMENT

**ORDER REPUBLIC RUBBER PRODUCTS FROM YOUR DISTRIBUTOR**

# New Profits in "Ready-Mixed"!

POPULAR 1½ YD. UNIT, mounts on Ford, Chevrolet, International, Studebaker, Reo and other short wheel base trucks.

## These 1936 Jaeger Truck Mixers Serve a Wider Market, Show a Longer Profit on Every Yard of Concrete Delivered . . .

Two-Range Mixing Speeds to provide for long and short hauls—faster, more flexible Two-Speed Discharge—the use of Man-Ten Alloy Steel to reduce truck load while adding strength—these latest Jaeger developments now make possible delivery of concrete to a wider area, furnish more payloads, and cut the cost of serving every job.

These 1936 features are additional to the recognized Jaeger advantages of lowest center of gravity, flexible 3-point mounting, complete one-man operation of mixer and discharge chute, and the unequalled quality of concrete produced by Jaeger's Dual-Mix, Double End Cone Drum—advantages which have, for years, enabled Jaeger operators to sell more concrete than is sold by any other method or equipment.

Whether you are planning or already operating a "ready mixed" service, you can profit by Jaeger's mechanical improvements and wide experience with the country's most successful plants. Our new catalog gives valuable operating data and details of most efficient, low cost plant set-ups for markets of less than 10,000 population up. Write for your copy today.

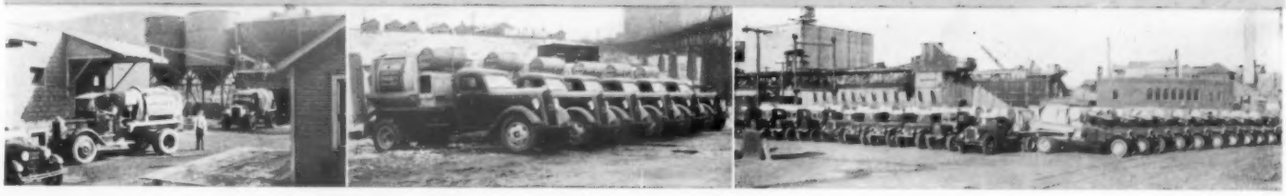
BUILT IN 1 TO 5 CU. YD. SIZES—Side Discharge or End Discharge Types.

**THE JAEGER MACHINE CO.**

World's Largest Manufacturers of Concrete Mixing Equipment

602 DUBLIN AVENUE COLUMBUS, OHIO

## The Majority of Recognized Plants, Large and Small, are Buying Jaeger Truck Mixers



# HUGS LAST LONGER

*because* HUG BUILDS TRUCKS SPECIFICALLY FOR YOUR JOB

● *One of a fleet of 3 Model 87Q Hugs with special 6-yard Phoenix type side dumping quarry body receiving its load from the shovel. These trucks were purchased by the East St. Louis Stone Company, East St. Louis, Illinois.*

● *Lower photograph shows load being dumped by external dumping device.*

IN QUARRY and stone product operations the severe abuse and shocking power of solid rock when loaded, plus steep grades with abrupt holes and jagged bumps, calls for an exceptional truck with real guts to take the terrific beating of constant quarry service. Hug quarry models have proven their superiority over ordinary trucks in quarry operations time and time again because Hugs have that *extra stamina built into every part.* From axles to body canopy, from tail gate to bumper, these massive transportation units are designed to meet the most severe conditions encountered in quarrying and stone operations and show a profit even after years and years of service.

Hug offers a complete line of quarry models ranging from 5 to 12 cubic yards capacity, available with various types of quarry bodies to meet your specific hauling operation.

Tell us about your transportation needs. Let our engineers study your individual requirements and recommend specially designed and built Hug equipment.

HUG

**THE HUG COMPANY**
592 Cypress Street • Highland, Illinois

## BUILT TO MEET A CONDITION

No Diesel can be any better than it's FUEL SYSTEM
Read the record
UNITED STATES ENGINEER DEPARTMENT
LOS ANGELES DISTRICT
OSGOOD

*One of three new Cummins diesel-powered Osgood cranes just delivered to the United States Engineers for use on the Upper Ballona Creek job of their seventeen million flood control program in Los Angeles County.*

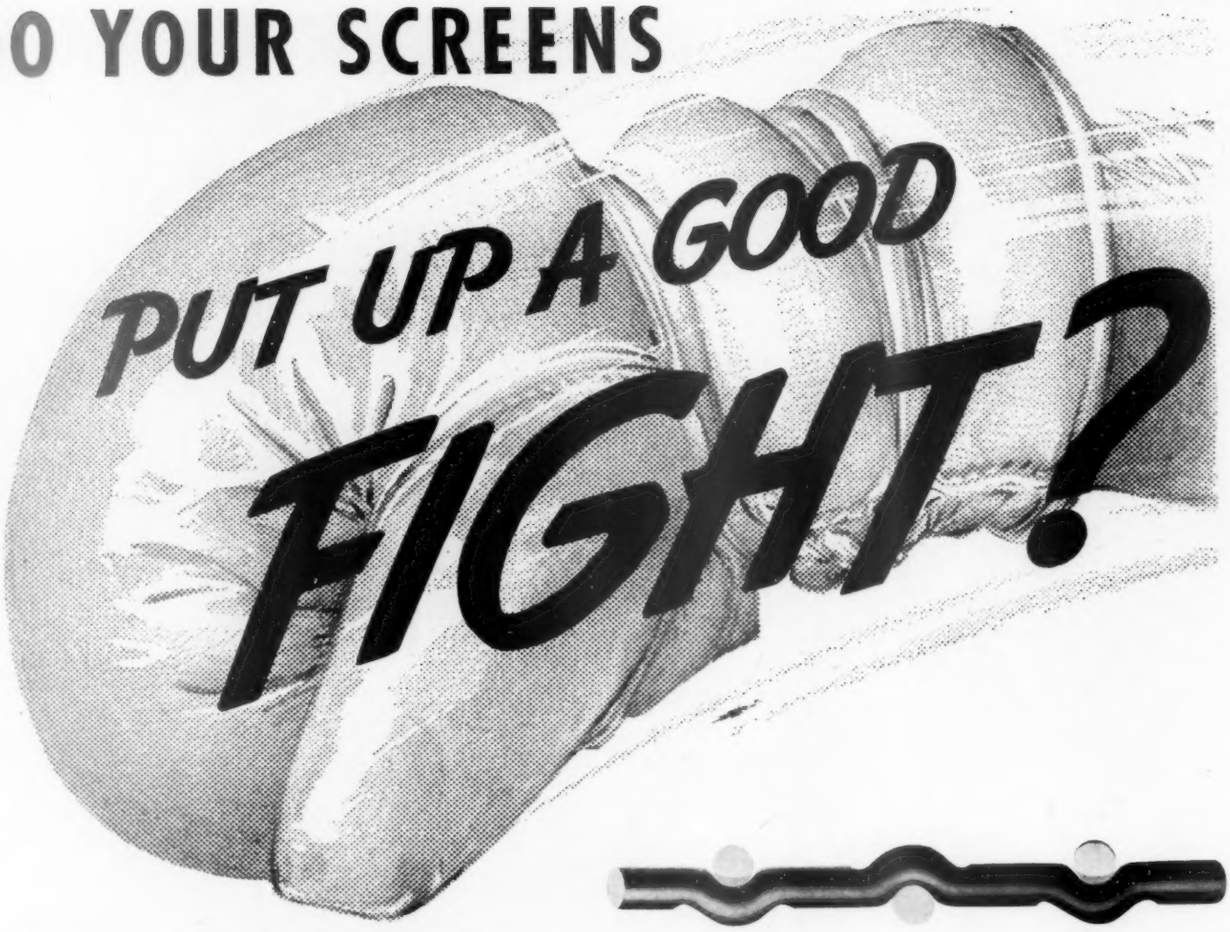
**Acceleration** *without Vibration*
**Lighter** *in Weight*
**Flexibility** *and Cold Starting*
**Backed** *by Good Service*

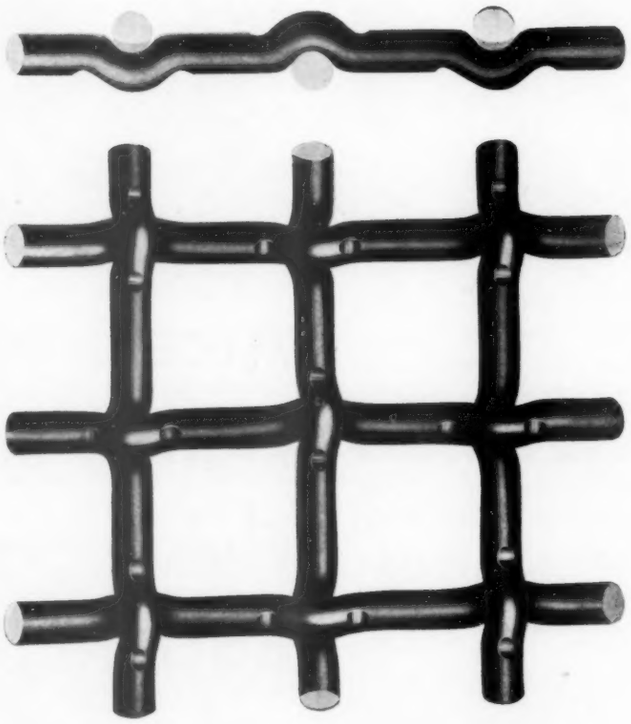
**CUMMINS ENGINE COMPANY, 806 WILSON STREET, COLUMBUS, INDIANA**

# CUMMINS-DIESELS

**INDUSTRIAL • AUTOMOTIVE • MARINE**

# DO YOUR SCREENS



It takes wire with plenty of toughness and stamina...with plenty of FIGHT...to stand up under the constant wear and tear of screening operations...and to give long, efficient service in the bargain.

90 years of wire making experience goes into the wire for Roebling Wire Screens. That is why they are able to meet the severest requirements as to strength, vibration and abrasion.

We would welcome an opportunity to cooperate with you in solving your wire screen problems. Roebling Wire Screens are available for sizing, cleaning and grading...in types and metals for all needs.

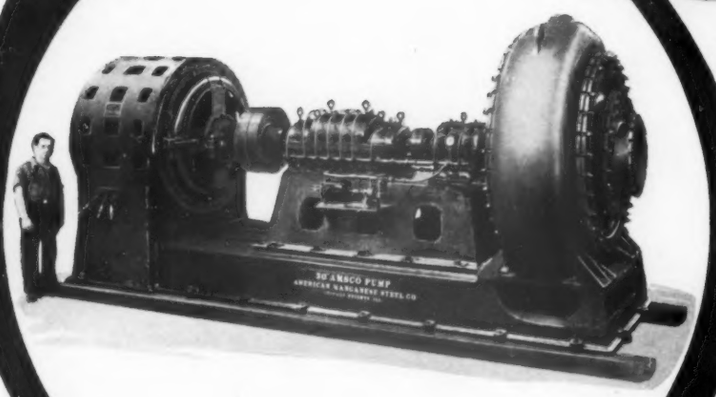
JOHN A. ROEBLING'S SONS COMPANY
TRENTON, N. J. *Branches in Principal Cities*

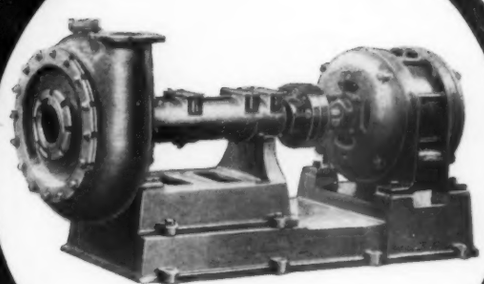
## ROEBLING *Wire Screen*

TRADE JERSEY MARK

**90 YEARS OF WIRE MAKING SPELLS THE DIFFERENCE**

# From 3" to 20"





## AMSCO Manganese Steel Materials Handling Pumps!

No matter what your materials pumping problem may be — there's an AMSCO Pump in type and model just suited to your needs.

AMSCO Manganese Steel Pumps are made in all sizes from 3" to 20" for pumping materials of all kinds.

An interesting comparison of capacities, dimensions, etc., of the two AMSCO Manganese Steel Pumps illustrated follow: Small Pump, size 3", nominal capacity 230 g.p.h., solids capacity 7 to 10 yards per hour; height 2'3", length 4', weight with motor 1 ton. Large Pump, size 20", nominal capacity 12,000 g.p.h., solids capacity 360 to 520 yards per hour, height 8'6", length 19'6", weight with motor 40 tons.

AMSCO Pumps feature durability of construction, lasting efficiency, accessibility of all parts, and a much longer service life because all water-end parts are made of manganese steel, the toughest, abrasion-resistant steel known! They are widely used for pumping sand and gravel, and wasting sand in commercial aggregate plants.

Flap Valves, Elbows, Slip Joints, Pipe, Nipples, Reducers, and other manganese steel parts are included in the AMSCO Line of Materials Pumping Equipment.

May we furnish you with operating details on AMSCO Materials Handling Pumps?

**AMERICAN MANGANESE STEEL COMPANY**

*Division of American Brake Shoe & Foundry Company*

396 East 14th Street, Chicago Heights, Ill.

*Foundries at Chicago Heights, Ill.; New Castle, Del.; Denver, Colo.; Oakland, Calif.; Los Angeles, Calif. • Offices in Principal Cities*

**AMSCO**

TRADE MARK REGISTERED

# 2 HIGH SPOTS IN WIRE ROPE MANUFACTURE

• Purple Strand—in itself—is an unusual rope where **extreme** strength is required.

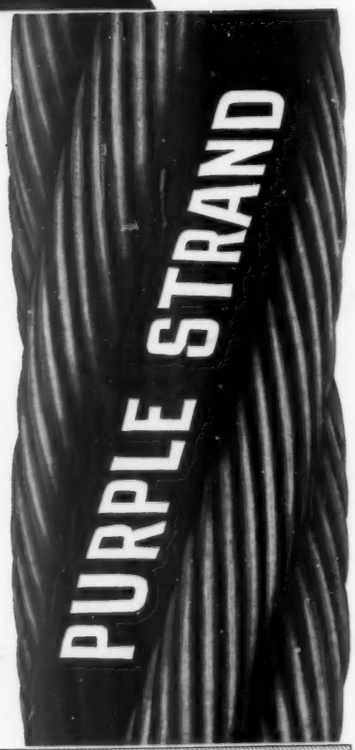
and

• Where Preformed suits your requirements better, "Form-Set" Purple Strand—Williamsport's method of Preforming—will give you remarkable service.

Let us send you our new Catalog and manual just off the press. Tell us what your requirements are and the service you require, our engineers will gladly aid you.

You'll be pleased with our way of doing business.

Purple Strand




Form-Set

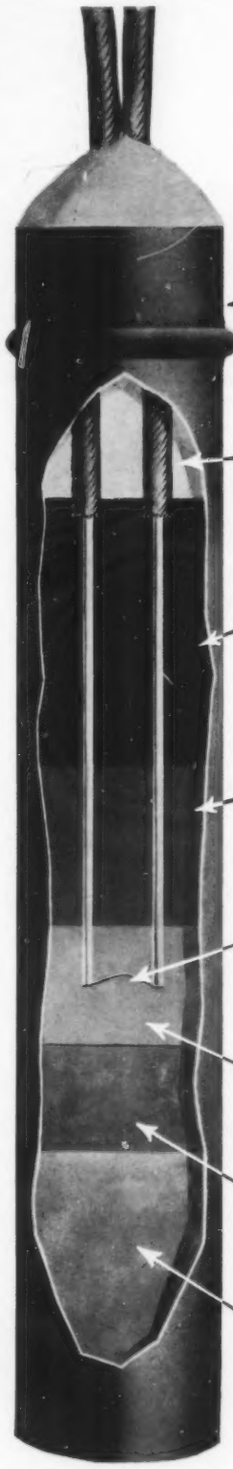
Williamsport

WIRE ROPE COMPANY

Williamsport, Pa.

122 So. Michigan Ave., Chicago, Ill.

*Other Offices in All Principal Cities*



**CROSS SECTION SHOWING STURDY, DEPENDABLE CONSTRUCTION**

**COPPER SHELL**
Carefully annealed to prevent cracks. Dipped in lacquer before loading for detection of "pin holes."

**SULPHUR SEAL**
Specially compounded sulphur. Will not corrode copper nor eat insulation on leg wires.

**WATERPROOFING**
Efficient waterproof compound. Sticks to shell and leg wires, thus preventing moisture from creeping along leg wires and shell. Will not shrink in cold.

**PLUG**
Holds leg wires precise distance apart, relieving possible strain on bridge wire.

**BRIDGE WIRE**
Amazing example of precision manufacture. *Fifteen ten-thousandths* of an inch in diameter. Composed of four alloys to give right resistance to assure positive, dependable detonation.

**IGNITION CHARGE**
Ignites when bridge wire fuses Will not corrode bridge wire, soldered joints or leg wires.

**PRIMING CHARGE**
Dense, powerful explosive that insures detonation of base charge at maximum velocity.

**BASE CHARGE**
Detonates at highest velocity of any commercial explosive.

# DU PONT ELECTRIC BLASTING CAPS

## *Insure Complete Detonation of Your Shots*

MONEY and time are required to prepare a shot. Don't risk losing both. Use an electric blasting cap that insures a complete detonation.

Du Pont Electric Blasting Caps are precision-built and sturdily constructed to withstand handling in use and transportation; long storage, and submersion in water. They are the world's largest-selling electric blasting caps. More than Nine Hundred Million have been used in the past twenty-five years.

**E. I. DU PONT DE NEMOURS & CO., INC.**

**EXPLOSIVES DEPARTMENT, WILMINGTON, DEL.**

BRANCH OFFICES: Birmingham, Ala.; Boston, Mass.; Chicago, Ill.; Denver, Colo.; Duluth, Minn.; Huntington, W. Va.; Joplin, Mo.; Juneau, Alaska; Kansas City, Mo.; New York, N. Y.; Pittsburgh, Pa.; Portland, Ore.; Pottsville, Pa.; St. Louis, Mo.; San Francisco, Calif.; Scranton, Pa.; Seattle, Wash.; Spokane, Wash.; Springfield, Ill.; Wilkes-Barre, Pa.

DU PONT
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# EXPLOSIVES

## *and Blasting Accessories*

# We've Entered a New Age of Engineering

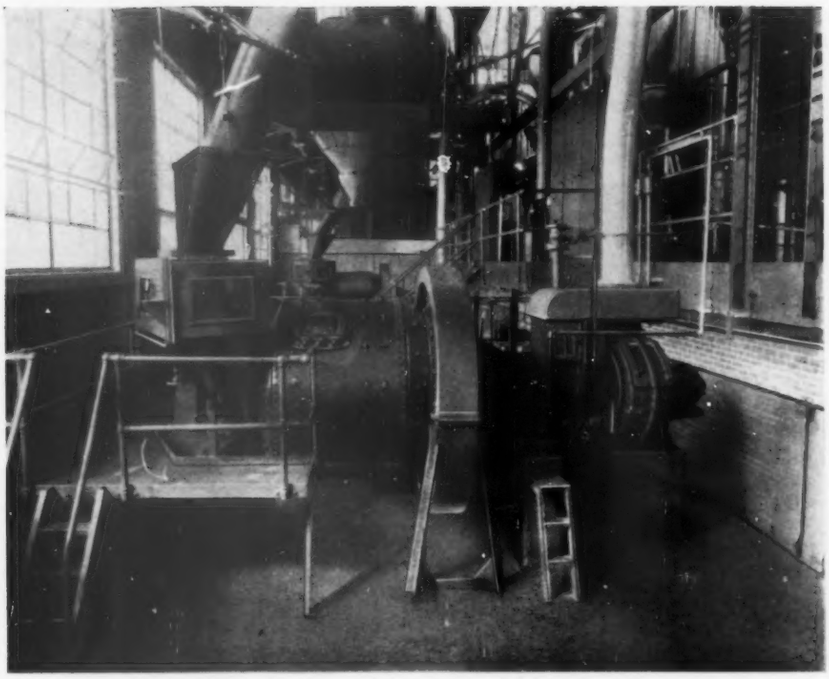
## the P&H WARD LEONARD SHOVEL FASTER

IN step with the changes which are taking place in all lines of industry, Harnischfeger presents the new P&H Ward Leonard shovel with complete one-man control. It brings wholly new ability into the field for open pit mining.

New high tensile steels, stronger and far lighter, have thrown off the burden of dead weight, reduced inertia. New mechanical improvements have made it smoother-running, easier to operate. Greater power has given it greater speed to produce more by producing faster.

**HARNISCHFEGER CORPORATION**

**4451 West National Avenue** *Established 1884* **Milwaukee, Wis.**



# Hardinge Unit Pulverizers Grind 16200 Tons of Coal Per Day

*(More than is now used by the entire cement industry. This in addition to all our storage system installations and those grinding coke and anthracite coal)*

Hardinge Unit Pulverizers are ideal for direct firing cement Kilns. The operator need only adjust the fuel supply to the kiln. The mill feeder is regulated automatically by a unique but positive mill level control.

This mill is second to none in low maintenance costs (if you doubt this statement we can give you proof).

The energy expended is proportioned to the work done due to the conical shaped drum with its ball classification properties.

One of our many successful installations is bound to be similar to your requirements.—Write for details today.

HARDINGE COMPANY
INCORPORATED
YORK, PENNA.—Main Office & Works
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# HARDINGE

# Trouble *here* would halt production so..

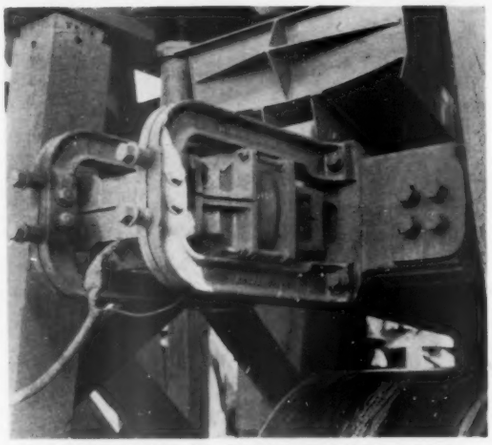
## JEFFREY-TRAYLOR FEEDERS WERE CHOSEN

An important item of the equipment used in the sand and gravel storage plant which supplies material for the construction of Pickwick Landing Dam, Pickwick Landing, Tenn., is the Jeffrey-Traylor Electric Vibrating Feeder.

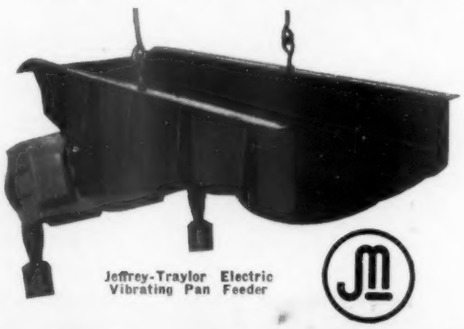
The feeding of material to the conveyor system at a steady rate of speed makes possible the utilization of the full capacity of the plant equipment. Any failure of this Feeder or lack of capacity when needed would seriously disrupt operating schedules.

This is just one of the many instances where Jeffrey-Traylor Feeders are proving their worth as key equipment in maintaining high speed capacity and efficient operation at all times.

Besides Feeding, the J-T patented principle of controlled vibration is applicable to screening, conveying, drying, cooling and packing. Write for Catalog No. 620-J explaining the many distinctive features of Jeffrey-Traylor Electric Vibrating Units.



The J-T Electric Vibrating Feeder is shown in the oval above. The Pickwick Sand and Gravel Plant is shown in the larger view. Next above is a rear view of the J-T Feeder showing the power units and the belt conveyor onto which it feeds.



Jeffrey-Traylor Electric Vibrating Pan Feeder

## THE JEFFREY MANUFACTURING COMPANY

**917-99 N. 4th Street, COLUMBUS, OHIO**

Quicker WELDING Better PENETRATION Longer WEAR

**Weld manganese and carbon steel castings and forgings with . . .**

# TIMANG

*(AIR-TOUGHENING)*

## MANGANESE WELDING ROD

From every angle you'll get greater efficiency from TIMANG. It's easier for any welder to use because it flows freely and welds quicker . . . without affecting the metal close to the weld. And the finished weld will be as tough and strong . . . with the same resistance to wear . . . as the parent metal.

TIMANG is the original air-toughening manganese steel welding rod . . . developed in TISCO laboratories . . . and now used extensively for repairing and building up manganese steel wearing parts and carbon steel forgings and castings.

TIMANG is sold direct and through sales organizations. Your jobber or distributor handles this rod . . . in some cases under a private trade name. Be sure you insist on the Taylor-Wharton product. Bulletins on request.

**TISCO** products include manganese steel pump parts, cutter heads, dippers, buckets, dipper teeth, racks and pinions, jaw plates, cheek plates, hammers, liners, mantles, screen cloth, perforated plate, grinding balls, etc.

**WRITE FOR BULLETINS**

TW

## TAYLOR-WHARTON IRON AND STEEL COMPANY

**HIGH BRIDGE, NEW JERSEY**

PLANTS AT HIGH BRIDGE, N. J.—EASTON, PA.

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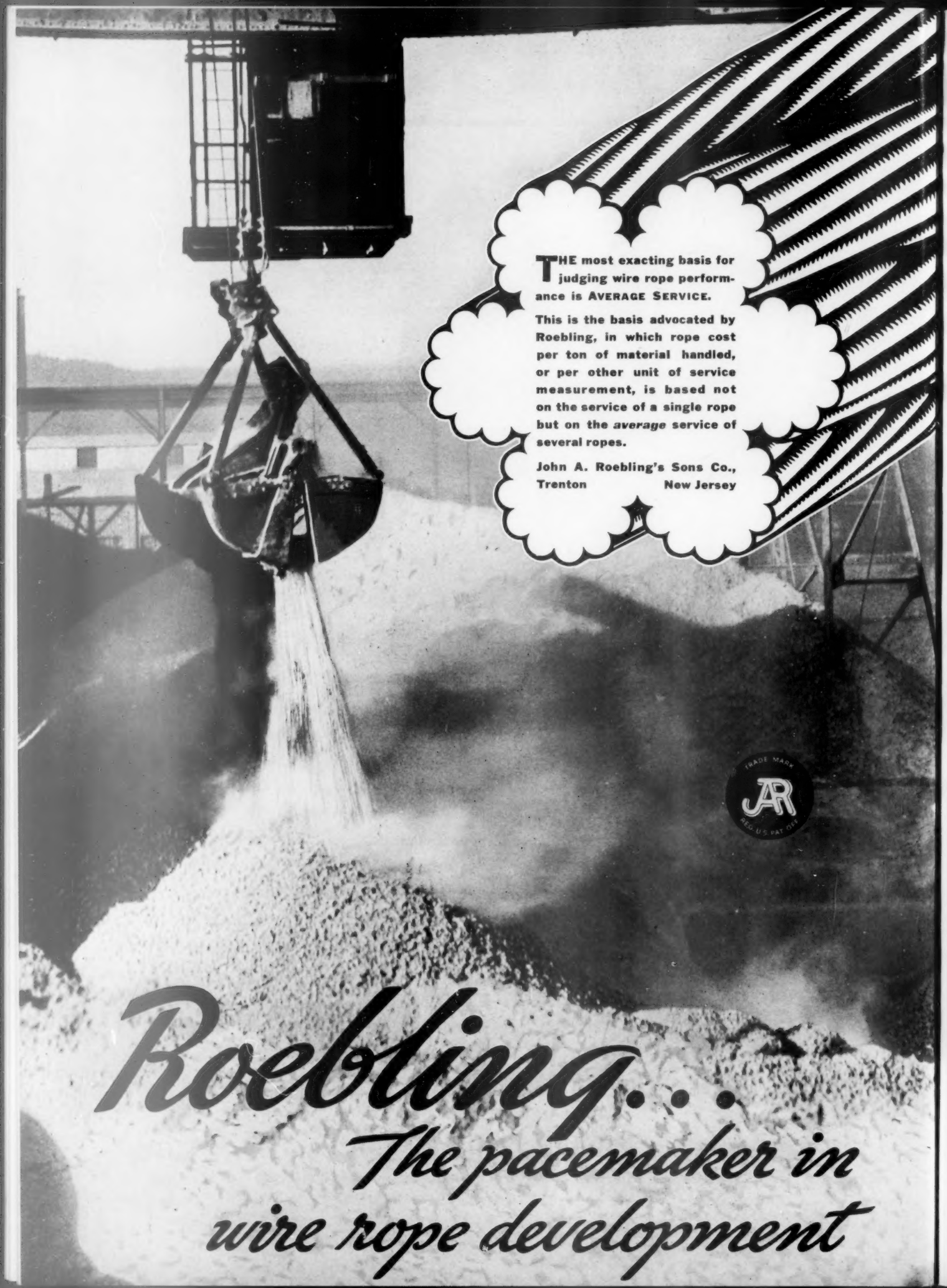
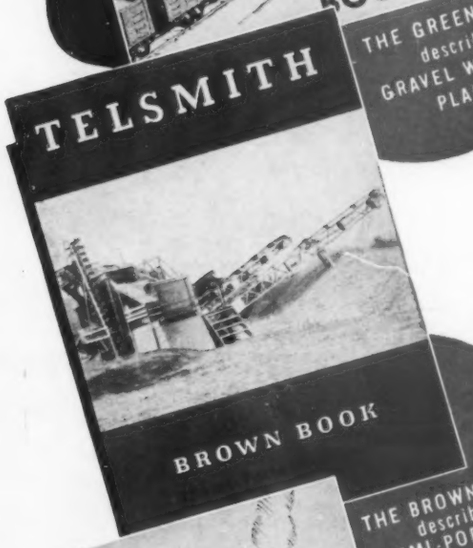
Montreal, Quebec — London, England — Penang, F.M.S. Also represented at The Hague and Dutch East Indies.


THE most exacting basis for judging wire rope performance is AVERAGE SERVICE.
This is the basis advocated by Roebling, in which rope cost per ton of material handled, or per other unit of service measurement, is based not on the service of a single rope but on the *average* service of several ropes.
John A. Roebling's Sons Co., Trenton New Jersey
TRADE MARK
JAR
REG. U.S. PAT. OFF.
Roebling . . .
The pacemaker in
wire rope development

# THESE 3 BOOKS TELL YOU all you want to know about *Plant Layout*

THE GREEN BOOK describes GRAVEL WASHING PLANTS




THE BROWN BOOK describes SEMI-PORTABLE QUARRY and GRAVEL PLANTS

THE BLUE BOOK describes QUARRY PLANTS

**What's new in plant layout? What has been the influence of today's conditions, competition, and markets? What changes have new and improved equipment brought about in layout and production . . . in gravel washing plants . . . in quarry plants? Where do semi-portable plants fit into the present picture?**

**You will want to know the answers to these questions . . . and to other questions pertaining particularly to your own plant . . . whether you are modernizing or planning a new plant.**

**That's the purpose of these three books. They contain diagrams of actual plant layouts . . . of every size and type . . . with descriptions and specifications of their equipment and how it has been balanced and coordinated to give the wanted results.**

**Diagrams! Facts! Figures! Complete information in concentrated form — with the old "selling talk" hooey left out.**

**Any one or all these books . . . GB-15 (Gravel Washing Plants); SP-15 (Semi-Portable Plants); QP-15 (Quarry Plants)... are yours on request *without cost or obligation.***

## SMITH ENGINEERING WORKS

**504 E. CAPITOL DRIVE** **MILWAUKEE, WISCONSIN**

Associates in Canada: Canadian Ingersoll-Rand Co., Ltd.
Montreal, Toronto, Winnipeg, Vancouver.

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Brandeis M. & S. Co. Louisville, Ky.
L. V. Fraley & Son St. Louis, Mo.
Choctaw C. & M. Co. Memphis, Tenn.
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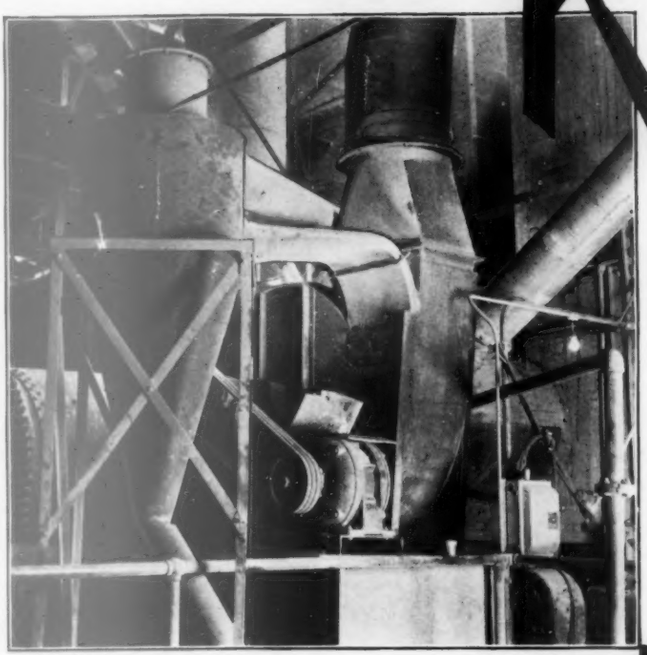

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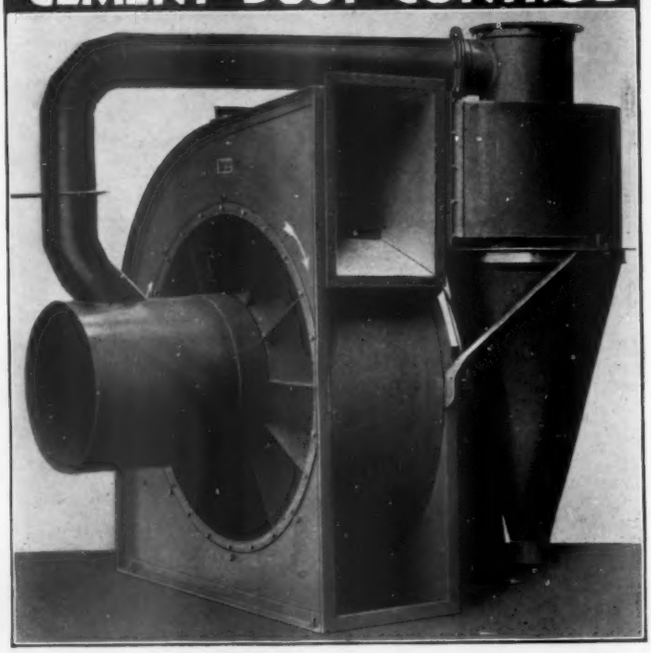

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SEP 28 1936

# PIT AND QUARRY

Vol. 29 JULY, 1936 No. 1

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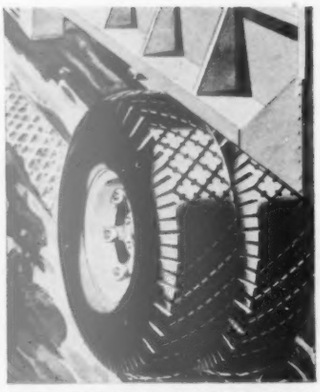

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# GENERAL TRUCK TIRES

PIT AND QUARRY

CHICAGO JULY, 1936

## Cement Industry Now Operating at Profit

### PRICES ARE RELATIVELY STABLE

The Portland-cement industry will operate in the black during the current year for the first time since 1931, according to present indications. Though for the past two years or so certain producers have been able to report moderate earnings due to special favorable circumstances, the trade as a whole up to recently was on an unprofitable basis.

This year, however, reflecting a substantial advance in sales accompanied by a relatively stable price structure, it is likely that nearly all manufacturers will operate profitably and those which have been making money will enjoy a further decided earnings upturn.

Leading interests in the industry foresee a sales gain of at least 30 per cent. this year. This figure represents an upward revision of about 5 per cent. during the past month as the result of a greater than anticipated bulge in demand.

Currently the industry is running at better than 45 per cent. of capacity, with prospects pointing to a 35 to 40 per cent. ratio for the entire year. This would compare with a ratio of 28.6 per cent. in1935, 29 per cent. in 1934 and the low point of 23.6 per cent. in 1933. The capacity of the country's 163 plants is estimated at 262,700,000 bbl.

Although all sections of the country are participating in the upswing, the greatest gains are on the Pacific Coast and in Texas. During the four months ended with April, sales in the three Pacific Coast states were 85 per cent. over the like 1935 period. California was particularly outstanding with a 90 per cent. increase. The acceleration in volume on the Pacific Coast is due partly to the Grand Coulee and Bonneville projects and aqueduct building in Los Angeles. California's total was also aided by a sharp revival in general construction activity.

The four months' increase in Texas amounted to 71 per cent. In addition to response to generally improving business in the Southwest, demand has been stimulated by increases in oil drilling.

## Lehigh Declares First Dividend in Five Years

For the first time in more than five years, the Lehigh Portland Cement Co. has declared a dividend on its common stock. The dividend amounting to 25c. per share, is to be payable August 1 to stock of record July 14.

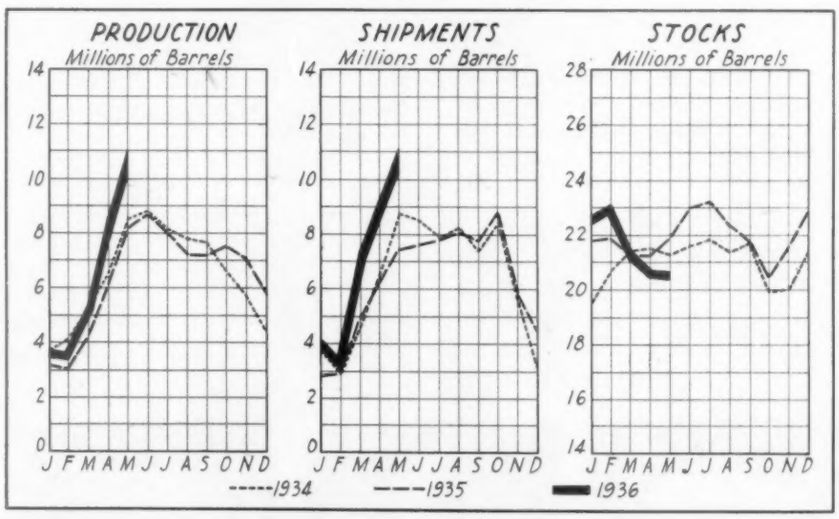
The last dividend, also 25c. per share, was disbursed May 1, 1931.

## Federal Aid for Roads Assured Until 1939

President Roosevelt on June 16 signed the new Hayden-Cartwright bill which provides Federal-Aid for highways for the fiscal years ending June 30, 1938, and June 30, 1939. This bill also includes an appropriation for secondary roads which is a decided innovation and gives recognition to the value of this type of road.

★ The Ward Sand & Gravel Co., Oxford, Mich., has installed a new 24-in. by 16-in. roll crusher built by the New Holland Machine Co.

## CEMENT SHIPMENTS AT 5-YEAR PEAK




Production and shipments of Portland cement in May, 1936, were at the highest level for any month in five years. The mills turned out 10,985,000 bbl. of finished product, shipped even more—11,121,000 bbl. and stocks declined to 20,435,000 bbl., a bare two-months' supply.

Compared with May of last year, production was 33.6 per cent. higher and shipments were up 49.7 per cent.

Nearly half the existing capacity as rated by the U. S. Bureau of Mines was utilized in May of this year, the ratio being 48.9 per cent. The estimated capacity of 160 plants is used by the Bureau in arriving at this figure. A year ago only 36 per cent. of the capacity was utilized.

For the first five months of this year cement shipments have totaled 34,393,000 bbl. compared with 24,301,000 bbl. in the same period of 1935, a gain of 41.3 per cent.

## Blaine S. Smith Will Head Universal Atlas

**AFFLECK TO RETIRE SEPT. 1.**

Benjamin F. Affleck, president of the Universal Atlas Cement Co., will retire September 1 under the U. S. Steel Corp. pension plan, of which the company is a subsidiary, to devote his time to private interests. He will be succeeded by Blaine S. Smith, who was vice-president of the organization before going to New York in 1928 to head the Pennsylvania-Dixie Cement Corp. Mr. Smith, who in his new position will have headquarters in both Chicago and New York, is resigning his post as president of Pennsylvania-Dixie. Mr. Smith's successor will be John A. Miller, former president and chairman of the Penn-Dixie board.

Mr. Affleck was one of the early members of the Portland Cement Assn. and was largely instrumental in reorganizing it in 1916 along its present lines. He served as its president for five years. In 1896 he began as stenographer for the Illinois Steel Co. (now the Carnegie-Illinois Steel Corp.). In 1901 he became branch manager at St. Louis of that company's cement department, which, in 1906, became a subsidiary of the United States Steel Corp., and Mr. Affleck became general sales manager.

In that position he developed an outstanding sales organization and in 1915 was elected president. During his service with the cement company its business grew from 30,000 to 30,00,000 bbl.

For more than twenty years preceding 1928, Mr. Smith was connected with the company he will now head. Following ten years of service in the traffic department of the Chicago & North Western Railway, he joined the Universal Atlas Cement Co. organization in 1908. He started as a salesman and advanced through various positions to that of general sales manager in 1915, in which position he also succeeded Mr. Affleck, who became president. In 1926 Mr. Smith was elected vice-president, from which position he resigned in 1928 to become president of the Pennsylvania-Dixie Cement Corp.

Mr. Smith has been active for many years in the Portland Cement Assn., serving as president for 1925 and 1926. He was also president of the Cement Institute for 1929 and 1930 and is now a member of the boards of both organizations.

Mr. Miller has been actively connected with and well known in the industry for 36 years, first as president of the Dexter Portland Cement Co. and the Clinchfield Portland Cement Corp. prior to the formation of Pennsylvania-Dixie, and since then as president and chairman of the board, respectively, of the Pennsylvania-Dixie Cement Corp. since its organization.

## P.C.A. Reduces Field Forces on East Coast

Field forces of the Portland Cement Assn. along the eastern seaboard from Maine to Maryland have been reduced approximately 35 per cent. The reason for this curtailment of activity, it is reported, is due to the fact that too many of the cement producers shipping in that area are not association members and have been sharing in the increased sales traceable to association promotion. Efforts are being made to induce these companies to join the association. Should this be accomplished, a renewed and vigorous campaign for concrete will be instituted.

★ Crushing facilities were improved recently at the plant of the Friend Sand & Gravel Co., Petersburg, Va., by the addition of a No. 2 Symons reduction machine. Other changes are contemplated later on this year.

B. F. Affleck

Blaine S. Smith

John A. Miller

(Smith photo by Moffett; others by Blank & Stoller.)

## Predict Carloadings Gain in 3rd Quarter

**CEMENT TO SHOW BEST INCREASE**

Shipments of Portland cement, stone, gravel, sand, lime and plaster over the railroads in the third quarter of the year will reach 539,307 carloads, according to the forecast of the Regional Shippers' Advisory Boards. This compares with loadings of 485,639 cars in the same period of last year, or an estimated increase of 11.5 per cent.

Portland cement will show the greatest increase, it is indicated, with a gain of 14.3 per cent. Lime and plaster shipments will be 12.7 per cent. above the July-August-September period of 1935, while gravel, sand and stone shipments will require 383,881 cars—or 9.9 per cent. more than in the same quarter of last year.

The estimates of the Advisory Boards are always extremely accurate and, while they do not take into account the vast tonnages of commodities moved by motor truck and water, are excellent indices of industrial activity.

## Illinois Has Extensive Road-Building Program

A highway-construction program costing $37,670,000, an increase of more than $15,000,000 over expenditures in 1935, has been announced by the Illinois Department of Public Works. The new program will include 138 miles of concrete pavement, 51 miles of bituminous-surfaced gravel or stone, 137 miles of gravel or crushed-stone surfacing, 522 miles of grading, 39 large bridges, 86 railroad grade separations, 3 highway grade separations and 81 miles of highway landscaping. Funds for the program will be secured from state and federal sources. Contracts amounting to over $13,000,000 have already been awarded.

## Pennsylvania's Roofing Slate Industry Gaining

The roofing-slate industry of Pennsylvania is making rapid strides toward recovery. Quarries in the Lehigh and Northampton County area are being reconditioned and production schedules are being increased. Operators probably will be able to sell all the roofing slate they can produce during 1936. The blackboard- and structural-slate branches of the industry are enjoying similar, though less marked, increases in activity. At all the quarries in this district, primary cuts are made with wire saws, a type of equipment introduced at the suggestion of the U. S. Bureau of Mines in 1926.

## Emergency Rates Are Extended to Dec. 31

**AGGREGATES SURCHARGE REDUCED**

In a decision which created a sharp division in the Interstate Commerce Commission, the railroads were authorized in a majority opinion to extend until December 31, 1936, the emergency freight charges authorized in the original proceedings in Ex Parte No. 115. Concessions were made as to a number of commodities, including sand, gravel, crushed stone and slag.

V. P. Ahearn appeared before the Interstate Commerce Commission during the hearings in behalf of the National Sand & Gravel Assn., the National Crushed Stone Assn., and the National Slag Assn., and submitted evidence and testimony in opposition to the request of the carriers for indefinite extension of the emergency charges. In that presentation the point was emphasized that while the aggregates industries had a sympathetic interest in the need of the carriers for additional revenue, "it is of no benefit to them or to ourselves to carry that sympathy to the point of refusal to recognize and face facts." The records of the Commission prove that rates on these commodities have been considerably in excess of what the traffic will bear, with the result that the sand-and-gravel industry, once standing ninth on the list of revenue-producing commodities, has found it necessary to resort to other means of transportation in order to protect its markets. It seemed to contradict all economic logic for the carriers, in the face of this undeniable circumstance, to seek to impose higher rate burdens on aggregate-producers.

The carriers sought an indefinite extension of the emergency charges, and that the Commission denied. It concluded, however, that industry in general could afford to pay the higher charges until December 31, 1936. As an indication that Mr. Ahearn's testimony impressed the Commission the following is extracted from the decision:

"Gravel, sand, broken stone, slag, and other low-grade road-building materials, are now subject to no emergency charge where the rate is $1 per ton or less. Rates, higher than $1 are subject to a charge of 7 per cent., maximum 1 c. per 100 lb. Complaint is made that this results in disadvantage to shippers whose rates are slightly higher than a dollar in competition with others having rates of $1 or slightly lower to the same market. For example, a rate of $1.01 is increased 7 c. to $1.08, whereas a rate of $1 remains unchanged, thus increasing the difference from 1 c. to 8 c. To provide a more reasonable grade, we conclude that, as to rates on these commodities which are higher than $1 but not higher than $1.10 per net ton, the emergency charge should be 4 c."

Commissioner Aitchison submitted a strongly-worded dissenting opinion, maintaining that the emergency surcharges should be allowed to expire.

The action of the Commission does not foreclose an effort by the carriers to maintain the surcharges beyond the new expiration date, but one is forced to conclude from the reading of the majority and minority opinions that such an application, unless new facts are presented, will stand little if any chance of approval.

## Name Oscar Lindahl to Universal Atlas Board

Election of Oscar N. Lindahl as a director of the Universal Atlas Cement Co., is announced by that company. The other four directors are William A. Irvin, president of the Steel corporation, B. F. Affleck, president of Universal Atlas, K. K. Knapp, attorney, and J. H. Kempster, superintendent of the company's plant at Buffington, Ind.

Mr. Lindahl is auditor and assistant secretary of the cement company, auditor and director of the Atlas Lumnite Cement Co., and auditor of the Atlas Gypsum Corp., all steel corporation subsidiaries. He has been connected with the steel corporation for nearly 30 years, being with the Illinois Steel Co. four years and with Universal Atlas since 1911.

He is a member and former director of National Association Cost Accountants, member and former president Illinois Manufacturers' Cost Assn., member Controllers Institute of America, and chairman accounting committee, Portland Cement Assn.

## Quarry in Alabama Being Dewatered; Repair Plant

In preparation for resumption of operations work has been started in pumping out the Moretti-Harrah Marvel quarry at Sylacauga, Ala. The Moretti-Harrah Co. is a new organization which has taken over the old plant, enlarging and remodeling it. Thirty men will go to work when operations are resumed.

## Monsanto Will Construct Phosphate-Refining Mill

★ The Monsanto Chemical Co., St. Louis, Mo., will soon begin erection of a phosphate-refining plant at Columbia, Tenn., at a cost of about $500,000.

## Extensive Changes at Inland's Stone Plant

**STORAGE SYSTEM INCREASED 50%**

Equipment for extensive additions and refinements in the Inland Lime & Stone Co. plant at Port Inland, Michigan, which was originally designed by the Stephens-Adamson Mfg. Co. in 1930, has been furnished by that company during the past year.

New vibrator screens have been installed in the screen house and a new type of shock-absorbing carrier has been developed to replace the steel-roller carriers used beneath belt-conveyor loading chutes wherever the impact from heavy lumps was causing excessive belt wear.

The main stone storage system has been increased by approximately 50 per cent. by lengthening one of the four storage conveyors, adding a new traveling stacker and building a new wing conveyor for one of the four original stackers. The reclaiming system beneath the storage piles was increased correspondingly by adding three new tunnel conveyors and lengthening the main collecting conveyor.

Two additional S-A live-roll grizzlies were installed in the loading dock for rescreening stone to be loaded into cars or boats for shipment.

The separate sand-handling and storage plant was completely revamped. Bucket-elevators were replaced by belt-conveyors and the sand-storage capacity was increased by the addition of an overhead shuttle belt-conveyor. A new tunnel belt-conveyor now reclaims sand and discharges it to the main stone-reclaiming system for delivery to boats or cars.

## Kentucky's Bill to Tax Cement Apparently Dead

The bill which was introduced in the current session of the Kentucky legislature to levy a tax on cement manufactured or used within the state has been reported unfavorably by the Committee on Revenue and Taxation. It is considered unlikely that the bill will be taken up again.

## Cement Plant in France Installs Dust Collector

★ Ste. Coloniale des Chaux & Ciments Portland de Marseille has installed a 40-in. American Air Filter Co. Rotoclone on a rotary cement kiln. This was manufactured and installed by the French associates and licensees of this company, La Ventilation Industrielle et Miniere, Paris.

## Government-Contracts Bill Passes Congress

**WAGES AND HOURS ARE DEFINED**

The Walsh-Healey government-contracts bill has been passed by both houses of Congress and forwarded to the president for his signature. The bill, which regulates wages and hours in the production of materials going into work contracted by the Federal government, may or may not affect the materials of construction as produced by the pit-and-quarry industries. Its interpretations in this regard are not exactly clear. Important provisions of the bill, which does not become effective until 90 days after it is signed, are summed up as follows:

1. Bid brokerage and bid peddling are prohibited by requiring that only "regular" manufacturers or dealers may bid on Federal contracts;

2. Contracts of less than $10,000 are excluded;

3. An 8-hr. day and a 40-hr. week are arbitrarily established. (This would have the most damaging influence if the bill should be construed to cover aggregates);

4. The Secretary of Labor is required to fix minimum wages consistent with standards prevailing in the particular community but only after hearing and investigation;

5. Male persons under 16 years of age and female persons under 18 years of age, as well as convict labor, may not be employed in carrying out Federal contracts;

6. The Secretary of Labor may make exceptions in respect to minimum wages and maximum hours, but for any overtime which is authorized, a rate of 1½ times the basic hourly rate must be paid by the employer;

7. No part of the contract may be performed, nor any of the materials manufactured or furnished under the contract be produced, under working conditions which are "unsanitary or hazardous or dangerous to the health and safety of employees engaged in the performance of said contract." Compliance with the inspection laws of states is prima-facie evidence of compliance with this subsection.

## Develops Process for Utilizing Waste Slate

A patented process has been developed in Great Britain for calcining the waste at slate quarries to make a lightweight concrete aggregate, according to the U. S. Bureau of Mines.

Calcining the crushed slate in a rotary kiln causes it to expand to a maximum of about seven times its original volume. A product light enough to float on water is thus made. Welsh slates that expand most readily occur in the Ordovician and Silurian formations. Although the product is quite porous it is relatively impervious to water because the minute cells are bounded by glassy walls. Tests show that the material compares favorably in use with other light-weight aggregates now on the market.

## New Quarry Firm Formed to Operate in Missouri

Announcement has been made of the formation at Kansas City, Mo., of the Kansas City Quarries Co. W. M. Spencer heads the concern which has acquired a 120-acre deposit at Independence, Mo., Kansas City suburb, where crushed-stone is to be produced. The company also plans to enter the ready-mixed-concrete business on a large scale.

## Concrete-Conduit Firm Buys Aggregate Plant

The Concrete Conduit Co., Ltd., of Colton, Cal., makers of a wide variety of concrete pipe, have purchased the plant and quarry of the Concrete Rock & Sand Co. near Colton. Practically all the production will be used by the pipe company in the manufacture of its product.

## Another Rock-Wool Plant Is Planned for Indiana

★ The Air-O-Cel Co. of Detroit, Mich., has purchased a 58-acre shale and limestone deposit near Lagro, Ind., and plans to erect a rock-wool plant there this year, according to reports.

Deposits in Wabash County, Indiana, are found to be ideally suited to the manufacture of the rock insulating material and the Air-O-Cel plant will be the fifth to locate there in the last few years. Three of the present plants are located at Marion, Ind., and the fourth at Lagro.

## Kingston Trap Rock Co. Moves to New Offices

Offices of the Kingston Trap Rock Co. and the Kingston Bituminous Products Co. have been moved from Plainfield, N. J., to the company's new building in Kingston, N. J.

★ A new 12-ton, 36-in. gage Whitcomb gasoline-mechanical type locomotive has gone into service at the Wedron, Ill., silica operations of the Wedron Silica Co. of Chicago.

## Industry in General Still Supports Code

**ADHERENCE HIGHER THAN AVERAGE**

Nearly 65 per cent. of the sand-and-gravel and crushed-stone producers investigated by the so-called Robert Committee were adhering, at the time the study was made, to the minimum-wage and maximum-hour provisions of the N. R. A. code (No. 109) of the crushed-stone, sand-and-gravel and slag industries.

Of 612 establishments surveyed, 396 had made no departure from code standards. These establishments employed 17,113, or 76.1 per cent., of the 22,466 workers employed by the 612 establishments.

Most of the departures (124 out of 189 establishments) involved changes in hours only and affected 2,598 out of 3,883 workers. Twenty establishments employing 478 workers made changes in wages only and 45 establishments employing 807 workers made changes in hours and wages.

The 64.7-per cent. record of the sand-and-gravel and crushed-stone industries in adherence is considerably higher than the average—55.6 per cent.—of the 38 industries surveyed. These included among others the construction, iron-and-steel, electrical manufacturing, certain forms of wholesaling, clothing manufacturing and general retailing industries. In the iron-and-steel industry, the record of adherence was 95.1 per cent. —136 establishments of 143 reporting. In the cotton-garment industry, which stood at the opposite end of the scale, the record was only 11.1 per cent.—215 establishments of 1,936 reporting. In all but 11 of the industries for which information was obtained more than half of the establishments reported complete observance of the wages and hours provisions of the old N. R. A. codes.

## N. Y. Governor Approves Three Silicosis Bills

Three bills relating to silicosis, passed by the New York legislature, have been approved by the governor. One limits the compensation for silicosis to $3,000. Its purpose is to revive industries in New York state in which there is a silica-dust hazard, industries that have been seriously affected by high compensation rates for silicosis protection. It also calls for the use of dust-control devices in all such industries.

Another bill appropriates $50,000 for a study of dust diseases, and the third establishes a fund of $100,000 for enforcement of preventative measures.

## Construction Volume in May Gained 70%

**ALL CLASSES SHARE INCREASE**

The volume of construction work started in May was more than 70 per cent. greater than was reported for May, 1935, according to F. W. Dodge Corp. The total for May amounted to $216,070,700, covering the 37 states east of the Rocky Mountains. During May, 1935, a total of only $126,720,100 was reported while in April of this year a total of $234,631,600 of construction work was undertaken in the area east of the Rockies.

For the first five months of 1936 total construction in the 37 eastern states amounted to $996,523,600. This was an increase of 81 per cent. over the volume of $548,501,600 reported for the corresponding five months of last year. Every important major geographic district shared in the general expansion.

The May, 1936, figures showed a total of $70,253,400 for residential building; $82,251,700 for non-residential building; and $63,565,600 for public works and public utilities of civil-engineering types. This latter category, with an increase of 100 per cent. showed the largest relative gain over the total for May of last year. In point of gain over last year non-residential building was next with an increase of 63 per cent. over the May, 1935 total. Residential building started in May of this year recorded an advance of 56 per cent. over the residential total for May a year ago.

For the first five months of the current year residential building in the 37 states amounted to $261,240,000, a gain of 65 per cent. over the volume reported for the like period of 1935. Non-residential building in the elapsed portion of 1936 amounted to $410,870,800 as compared with only $199,808,400 for the corresponding five months of 1935. Civil-engineering projects started thus far this year totaled $324,412,800 as compared with $190,352,200 for the initial five months of last year.

## Mehren, P.C.A. President, on Trip to West Coast

San Francisco business leaders welcomed Edward J. Mehren, president of the Portland Cement Assn., on July 6 when he arrived at the West Coast city for a week's business visit.

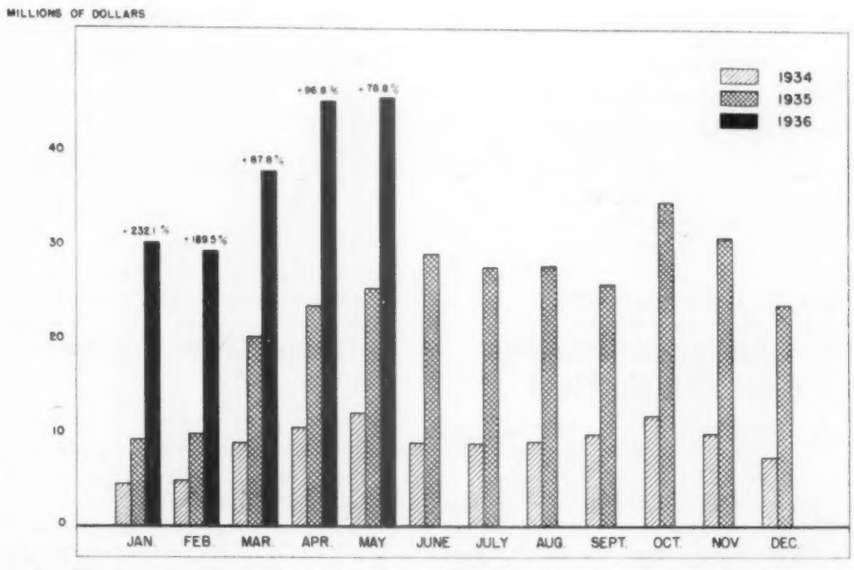
Mr. Mehren was the principal speaker at the San Francisco Advertising Club luncheon on Wednesday, July 8. His subject was "The Challenge to Business Leadership."

## Indiana Producer Builds Steel-Concrete Trestle

An old wooden trestle at the plant of the Koch Sand & Gravel Co. at Mt. Vernon, Ind., was recently replaced with a new structure built of steel and concrete.

Several other minor improvements have also been completed at the plant.

★ An 8-ft. Gayco separator is being installed in the sulphur plant of the Davison Chemical Co. at Curtis Bay, Md. The equipment was supplied by the Rubert M. Gay Division of the Universal Road Machinery Co.




Monthly value of residential building permits in principal cities, showing comparison with 1934 and 1935.

## Employment, Payrolls Record Steady Gains

**THOUSAND MORE OBTAIN WORK**

Employment and payrolls in the cement, quarrying and nonmetallic-mining industries in May, 1936, showed substantial gains over the preceding month, according to statistics released by the U. S. Department of Labor.

In 131 cement plants, 18,939 workers were employed in May, compared with 16,964 in April, a gain of 11.6 per cent. One-week payrolls were $415,682, compared with $361,153, up 15.1 per cent.

In 1,149 quarries and nonmetallic mines, 35,379 workers were employed in May against 32,899 in April, an increase of 7.5 per cent. One-week payrolls for May were $718,337, compared with $615,598 in the preceding month, a 16.7-per cent. gain.

## Gravel Operator Sells Cement-Products Plant

The Columbus Gravel Co., Columbus, Ind., has disposed of its subsidiary, the Garden City Concrete Products Co. The J. E. Evans Concrete Products Co. of Shelbyville, Ind., was the purchaser.

## Ohio Gravel Firm Will Install Branch Plant

The Buckeye Sand & Supply Co. of Bellaire, O., is planning to open a branch plant at Martin's Ferry, O., this summer. William Lonas will be manager.

## Lehigh's Plant at Iola Still World's Safest

The Iola, Kan., plant of the Lehigh Portland Cement Co. continues to hold its position as the safest cement plant in the world. For the ninth consecutive year, the company has unveiled the safety trophy awarded by the Portland Cement Assn. to those mills which operate a full year without a lost-time accident.

No accidents have occurred at the plant since September 9, 1926, and if the plant and quarry can maintain the pace another two months it will achieve the enviable record of ten consecutive years without a mishap to one of its workmen. Appropriate ceremonies are being considered in September in the event such a record is attained.

★ The Perkins Supply & Fuel Service, Des Moines, Ia., has purchased two 1-cu.yd. truck mixers made by the Concrete Transport Mixer Co.

## Holiday in Hannibal at Trophy Dedication

**UNIVERSAL ATLAS FETES WORKERS**

With more than a thousand people in attendance, the Hannibal plant of the Universal Atlas Cement Co. celebrated its best safety record in more than 30 years of cement making when it dedicated the Portland Cement Assn. safety trophy on Wednesday, June 24. The trophy was awarded to the plant in recognition of its accomplishment of maintaining an unmarred safety record during 1935. All employees, their families and civic and industrial leaders from nearby communities attended the dedication ceremonies.

By coincidence, Hannibal won this safety trophy in 1935, the year in which the city of Hannibal celebrated the Mark Twain centennial. At the present time, the plant has gone 692 days without a lost-time accident.

Principal address of the dedication ceremonies was made by Hon. James P. Boyd, general counsel of the Missouri Public Service Commission, who represented the state. Others on the program included H. A. Schultz of the industrial relations department of the United States Steel Corp., of which the Universal Atlas Cement Co. is a subsidiary, and B. F. Affleck, president of the cement company.

A. J. R. Curtis represented the Portland Cement Assn. in presenting the trophy. It was accepted on behalf of the plant employees by Franklin F. Webb. R. E. Hoffman, superintendent, delivered the address of welcome and presided.

## Soil-Improvement Plan Aids Sales of Agstone

Under the provisions of the soil-improvement program among farmers now in force, agricultural limestone sales are being greatly stimulated.

Farmers complying with the government's regulations regarding soil conservation can qualify for an additional payment of from $2 to $4 per acre if two tons of ground limestone are applied to each acre of ground. Producers are finding this provision an effective argument in promoting agstone sales.

## Amendment Allows Added Funds for Public Works

The public-works amendment adopted by the Senate as a part of the 1936 Deficiency Appropriation Bill will permit the P.W.A. to launch a new non-Federal public-works construction program costing over a half-billion dollars. This end was attained through releasing the cash and credits now in the P.W.A. revolving fund so that $300,000,000 may be used by P.W.A. for making grants as well as loans to aid in the construction of additional non-Federal public-works projects, This, together with the remaining $150,000,000 in the revolving fund which will be available for loans only, will enable P.W.A. to finance a non-Federal public-works program costing between $500,000,000 and $600,000,000.

## C. S. Huntington Named Chairman of Division

Vice-chairmen of the Manufacturers' Division of the National Crushed Stone Assn. have unanimously elected C. S. Huntington, Link-Belt Co., Chicago, Ill., as chairman of the division, succeeding the late Gordon Buchanan.

Mr. Huntington is widely known among aggregate producers and has long been active in the affairs of the Manufacturers' Division of the association.

## Crushed-Shell Producer Resumes Operations

The Dixie Shell Co., producer of crushed oyster shells at South Bend, Wash., has resumed operations under the management of Alvin Walkowski and L. L. Getchell.

## Cement Company Boosts Hourly-Workers' Wages

A blanket increase in wages of 10 per cent. for every employee working on an hourly basis went into effect July 1 at the Davenport, Cal., plant of the Santa Cruz Portland Cement Co. Approximately 200 workers were included in the pay raise.

## New Gravel Plant Will Be Built in Michigan

The Lake Superior Gravel Co. has been organized to produce washed sand and gravel, with a plant located on the Airport Road between Bessemer and Ironwood, Mich. Peter Giacherio, of Ramsay, Mich., is president.

## New Equipment Installed in West Virginia Plant

★ A crusher, vibrating screen, elevator and conveyor were recently installed at the lime and stone plant at Berkeley, W. Va., operated by the North American Cement Corp. The equipment was supplied by the McLanahan & Stone Co., Hollidaysburg, Pa.

## Prison Quarry Wins Safety Record Honor

**WORKS 717,168 SAFE MAN-HOURS**

The winners of the National Safety Competition of 1935, in which recognition was given to notable safety records attained during the year by numerous mines and quarries, have been announced by Dr. John W. Finch, Director, United States Bureau of Mines, which sponsored the contest.

For the first time in the history of the competition, the winner in one group, that composed of quarries and open-cut mines, was a quarry operated by a state prison. The Folsom State Prison quarry, in Sacramento County, Cal., worked 717,168 man-hours during the year without a disabling accident.

In the nonmetallic-mineral group for underground workings, first place was given to the Akron gypsum mine, Akron, N. Y., operated by the Certain-teed Products Corp., which was worked through 79,144 man-hours without a disabling accident.

## Lime Mortar Not Factor in Building Collapse

Newspapers in reporting the collapse of an apartment building under construction in the Bronx, New York City, late in June referred to the use of lime mortar as being a contributing factor to the failure.

Preliminary investigations by Lee S. Trainor, chief engineer, construction department, National Lime Assn. indicate that the masonry was sound and that the final report will absolve lime from any responsibility.

## Yosemite Will Consider Plans for Refinancing

Stockholders of the Yosemite Portland Cement Co. have been notified that the annual meeting of the company has been postponed until some time in October.

At that time, it is said, a plan will be presented for recapitalization, clearing cumulative dividend arrearages on the preferred stock and putting the concern in a position to pay current dividends on the Class A stock of the company.

★ July equipment shipments by the McLanahan & Stone Co., Hollidaysburg, Pa., included a washer and scrubber for installation at the Cape Girardeau, Mo., plant of Marquette Cement Mfg. Co., where an extensive improvement program is in progress.

## Shipments of Belgian Cement Fail to Gain

**ACTIVITY REMAINS STATIONARY**

Trade conditions in the Belgian cement industry during the first quarter of 1936 are described as stationary. The anticipated revival has not started. Exports last year totaled 821,687 metric tons, an increase of 111,090 tons. One-quarter of this went to Ireland, somewhat less to the Netherlands, and a sixth to the United Kingdom. Amounts of 47,558 tons, 54,908 tons, and 43,869 tons went to France, South Africa, and the United States, respectively, U. S. Bureau of Mines figures show.

The technical factors in making cement in Belgium are these: (1) The majority of the mills employ the wet process, using chalk principally from Hainaut which requires little grinding. (2) Some factories in the Tournaisis employ the dry process, using hard limestone which needs much grinding. (3) The average coal burned in the kilns contains 15 per cent. volatile matter and 18½ per cent. moisture and ash. (4) The average inland water haul costs 15 francs per metric ton. (5) Wages vary according to district.

## Cement Plant in Africa Installs Modern Crane

When executives of the Pretoria Portland Cement Co. of Johannesburg, South Africa, sought ways of putting production on the most efficient basis, they found the solution in American methods and equipment.

Typical of the manner in which this modern mill has been patterned after the larger plants in the United States, is the 6-ton P. & H. crane with a

**Overhead-crane installation at the South African cement plant.**

2-cu. yd. grab bucket serving one of the bays. Equipped with four fully enclosed electric motors, externally fan cooled, this unit has a hoisting speed of 150 f.p.m., bridge travel of 400 f.p.m., and trolley travel speed of 250 f.p.m. With all gears fully enclosed and bridge truck wheels of heavy-section rolled-steel construction, this crane represents the latest developments in American overhead crane engineering. Substantial reductions in the costs of material handling are reported through higher operating speeds and uninterrupted service. The installation was supplied by the Harnischfeger Corp., Milwaukee, Wis.

## Missouri-Illinois Buys Denton Gravel Co. Plant

The plant of the Denton Gravel Co., near Pacific, Mo., has been acquired by the Missouri-Illinois Material Co. After numerous repairs and improvements the plant will go into production under the management of Clyde Denton, who has been retained as superintendent by the new owner.

## Petoskey Installing New Dust-Collecting System

★ Three sets of dust collectors, to be supplied by the Northern Blower Co., Cleveland, O., are shortly to be installed in the packing department of the Petoskey Portland Cement Co., Petoskey, Mich., according to M. A. Eiben, president of the blower concern.

## Plans Barge-Unloading Dock at Redwood City

The Chianti Gravel Co. of San Francisco, Cal., with quarry and plant at Chianti, Cal., is planning to erect a barge unloading dock at Redwood City, Cal. Aggregates would be shipped by water from Petaluma under the plan, according to David Crowley, president.

## Miami Concrete Concern Buys Four Truck Mixers

★ Four truck mixers have been supplied the I. E. Schilling Co., pioneer ready-mixed-concrete producer of Miami, Fla., in recent months by the Concrete Transport Mixer Co., St. Louis, Mo.

Plans are in the making for extensive rebuilding of the plant of the National Gypsum Co. at Ft. Dodge, Ia., following the fire of a few weeks ago which destroyed the retarder mill, causing a loss of $30,000.

★ Five Minogue agitators have been delivered for installation at the plant of the Idaho Portland Cement Co., Inkom, Ida., according to H. G. Hubbard, superintendent.

## Sand, Gravel Output Increased Last Year

**CRUSHED-STONE SALES DECLINED**

The continued increase in construction activity in 1935 was reflected in an advance of about 14 per cent. in the output of commercial sand and gravel operations compared with 1934. Activity in road-building projects, however, apparently was about the same in 1935 as in 1934, for indicators of road and highway construction showed little or no gain. Available data on markets providing outlets for sand and gravel and partial returns from producers indicate that the total output in 1935 was about 125,690,000 short tons, valued at approximately $66,000,000, according to the U. S. Bureau of Mines. The increase in both production and value that began in 1934 following the 5-year decline was continued in 1935.

Sales of sand and gravel for virtually all uses increased in 1935 compared with 1934. Glass sand as well as grinding- and polishing-sand production reflected activity in plate-glass manufacture. Molding sand and fire and furnace sand followed the upward trend of the steel industry. Outlets for building sand and gravel were definitely better in 1935, although paving sand and gravel showed little change from 1934.

The average value of sand and gravel sold for most uses showed a slight decline in 1935 compared with 1934, although the average for the output of all commercial operations dropped only from 64c. a ton in 1934 to 63c. in 1935.

Sales of crushed stone in 1935 failed to maintain the upward trend begun in 1934. A drop of 15 per cent. in tonnage and 18 per cent. in value of commercial stone was contrary to the improvement of industry in general, which, according to the Federal Reserve Board index of industrial production, increased 14 per cent. Preliminary reports from producers indicate that sales, or use, of crushed or broken stone amounted to 77,521,000 tons, valued at $69,483,000. Comparable figures for 1934 were 91,283,233 tons, valued at $85,031,523. Including stone for cement and lime manufacture, for which no value is available because nearly all of it is produced by manufacturers for their own use, the total production in 1935 was 103,110,987 tons, 11 per cent. less than in 1934.

During the past 10 years, 1926 to 1935, inclusive, production of crushed and broken stone ranged from a peak of 189,793,150 tons in 1929 to a low of 89,952,950 tons in 1933. Assuming the 1923-25 average as equivalent to 100 per cent., the output of 1929 was 126 per cent.; of 1933, 60; of 1934, 77; and of 1935, 69 per cent.

# Editorial

## The Changing Supreme Court

UNFAVORABLE criticism of recent United States Supreme Court decisions comes from two quarters. There are those who feel that the majority group has not shown a sufficiently deep understanding of economic realities and that the minority opinions are more nearly in accord with the trend of modern developments. Others, while agreeing on the whole with the majority-group decisions, are critical of the minority group because of its inability or unwillingness to make those decisions its own. It seems that, unless the existing division of opinion among members of the court either disappears through the development of a greater tendency toward the adoption of unanimous decisions or becomes more pronounced through a widening of the numerical difference between its majority and minority sections, dissatisfaction with the court's rulings may be expected to increase. The present agitation for placing restrictions on its powers through constitutional amendment or other means, although not a novel phenomenon, has assumed new proportions and is supported by a more widely spread public sentiment than was audible before. The very fact that most of the important recent decisions affecting the economic interests of the country were the opinions of bare majorities of the court has probably done more than any other single factor to widen and strengthen that sentiment. For it is not unreasonable to suppose that, when authorities are divided by such narrow margins, the resulting decisions can not rest on very secure or conclusive foundations.

Those who had long hoped that the Supreme Court would become, as some of them expressed it, "more mindful of changed economic conditions and more clearly aware of basic economic truths" have voiced the belief that the narrowing margin between the majority and minority sections of the court betokened a broadening of viewpoint, which would soon lead to a reversal of identities and ultimately to more nearly unanimous decisions. The recent decision in the Sugar Institute case has been interpreted by many, wholly apart from its legal implications, as a definite sign of the newer and "more enlightened" attitude toward economic questions and is thought by them to be the forerunner of a series of decisions that will disclose a better understanding of realities and less diversity of opinion.

We see some reason for sharing that view, not alone or even particularly on account of the Sugar Institute decision, but because a review of Supreme Court decisions throughout the last two or three decades reveals just such a broadening of attitude. For that reason, and especially because the court's decisions are becoming increasingly important to business men in all fields, we believe that industrial leaders in important industries such as ours will serve themselves well if they make a serious study, in the light of present conditions, of the most important Supreme Court decisions of the last quarter-century. The Standard Oil and American Tobacco cases of 1911, the United States Steel case of 1920, and the trade-association cases—those of the Hardwood Lumber, Linseed Oil, Maple Flooring and Cement Manufacturers' Protective Associations—of the succeeding years are worthy of analysis as showing the court's imperfect understanding of the economic significance of practices then current in business. The decision in the Sugar Institute case seems to indicate a keener perception on the part of the court's members and presents a contrast in terms of economic understanding. We detect in its nature, and even more in its unanimity, a definite trend toward more clearly defined opinions on economic problems. This change may have very important effects on the basing-point pricing system, for example, especially as the Department of Justice, too, has shown some unmistakable evidence of having acquired deeper economic enlightment than its personnel possessed in the days of the cases mentioned.

THERE was a time when dissatisfaction with the Sherman Anti-Trust and the Clayton Acts was not confined to the corporations and corporation lawyers who feared prosecution under them, but spread to the prosecutors themselves, some of whom all but despaired of winning "satisfactory" and conclusive decisions. Even Herbert Hoover, then secretary of commerce, in his report for 1922 made a plea for changes in the "restraint of trade acts" and stated that the results of their application, as interpreted by the courts, were "in some directions . . . out of tune with our economic development". But now, since both the Department of Justice and the Supreme Court have given evidence of their increasing ability to see problems of price fixing, price discrimination and restraint of trade in the proper light, faith in the adequacy of those laws is reviving and we may look for a more determined attitude on the part of government prosecutors who expect to win convictions under them. This probability, coupled with the possibility of prosecution under the new Federal discriminatory-price law, should lead certain industries to revise their own views on the propriety of following practices that are now more likely than ever before to be successfully attacked in the courts.

Price fixing—generally called price "stabilization" by those who favor it—and price discrimination—except when made because of demonstrable differences in production or selling costs—are inimical to the free competi-

tion which the Sherman and Clayton acts were designed to preserve. No market can be considered free from restraint unless every seller and every buyer coming into it are free to act in their own interest as that may appear to them at the moment. Competition results when two or more sellers and two or more buyers attempt in the one case to sell and in the other to buy the same article, and this competition is free only when each one is guided by his own valuation of that article and is not subject to restraint from any outside force or to any agreement to refrain from offering either goods or money. When two or more sellers agree, either tacitly or otherwise, to fix—that is, to standardize—the conditions of sale in terms of price or in other ways, free competition is destroyed and restraint of trade results. The resulting monopoly, be it local or general, reduces the number of possible transactions and is, therefore, illegal under existing laws.

While competition between buyers may be active (especially if they are divided, as they almost always are), the competition between sellers is reduced under monopoly operations, so that monopoly can be described as one-sided competition. The cases mentioned provide examples of the ways in which—by the destruction of competitors, by agreement among rivals regarding open prices and the whole price structure (as in the basing-point system, for example), and by other methods—the desirable conditions that obtain in a state of free competition are destroyed.

The old idea that monopoly, in order to be monopoly, must necessarily be exclusive has given way to the better understanding of its nature which was shown as early as the Standard Oil case by Judge William C. Hook. In protest against the attitude of three of his colleagues, who sat on the case and who had asserted that "every sale and every transportation of an article which is the subject of interstate commerce is a successful attempt to monopolize that part of this commerce which concerns that sale or transaction," Judge Hook said: "What is monopoly in contravention of the statute? I would not say that every person who strives to gain as much as he can of the commerce in a commodity is thereby attempting to monopolize that commerce, within the meaning of the term as it is employed in legislative acts and understood in the courts. . . . Success and magnitude in business, the rewards of fair and honorable endeavor, were not among the evils which threatened the public welfare and attracted the attention of Congress. But when they have been attained by wrongful or unlawful methods, and competition has been crippled or destroyed, the elements of monopoly are present."

THE wide gulf between the old legal and the modern economic concepts of monopoly is disappearing, because the legal concept is undergoing that transformation needed to bring it into harmony with the economic concept. This trend may not be observable in the specific language of later decisions but it can be found in the spirit of those decisions as contrasted with that of earlier decisions. It may reasonably be expected that in future cases the court will take the attitude that the use of any device which has the effect of limiting the opportunities for trading constitutes a violation of law. The fact that certain practices may have escaped condemnation in the past is no guarantee that they will not be recognized in their true form when brought again before the bar. To precisely the extent that the old legalistic interpretation of monopoly is giving way, even among members of the Supreme Court and the government's prosecutors, to the more accurate, although less well understood, economic interpretation will the indifference to, or overlooking of, actual violations of anti-monopoly legislation give way to a clear recognition of their nature and effects. It is more than likely that, under the influence of the new viewpoint, every important business practice, even those whose legality has never been questioned, will be subjected to scrutiny for the purpose of determining whether or not it has the effect—entirely apart from any question of intent—of restraining trade and of creating monopolies or monopolistic tendencies irrespective of their incompleteness or exclusiveness.

NOTHING remains stationary, not even the Supreme Court, although the rate of its progress may be so low as to escape notice. Business, social, technical, economic activities are ever subject to change—changing methods, changing standards, changing viewpoints, changing objectives—and our attitudes toward them change. No system of jurisprudence, no legislative or administrative government machinery, could hope to persist without adjusting itself to the changing conditions that surround it. They may lag far behind, they may often seem to go backward, but they can not fail to advance except at the price of extinction. Court procedure, judicial attitudes, may fail to keep step, but they must now and then make heroic efforts to catch up, for the procession always threatens to outrun them. Even now the attitude of the Supreme Court is undergoing change; almost every day the attempt to keep its decisions abreast of modern business, social, and economic thought is made afresh. It is folly to expect it to do otherwise.

Every industry has some well-established practices that can not be justified by the standards set up by modern social and economic thinking. They may be prejudicial or harmful to other industries, to their sources of supply, to their customers, to their workers, even to themselves. It will be the duty of this generation, as it has been the duty of previous generations, to eradicate them or to mitigate their injurious effects. By the tests of present and future legislation they will be dragged across the legal scene before the searching gaze of sociologists, economists, legislators and jurists and according as they meet or fail to meet those tests will governmental efforts at regulation be relaxed or increased. Industrialists in all fields will be wise if they subject their present methods to thorough examination to determine whether or not they can successfully withstand the relentless scrutiny of a Supreme Court that is changing rapidly and may soon be in step with these rapidly-changing times.

# Gravel Assn. to Convene at Memphis Dec. 8 to 10

MEMPHIS will welcome the next annual convention of the National Sand & Gravel Assn. and the dates will be December 8, 9 and 10. This was the unanimous decision of the members of the association's board of directors who met in the St. Paul Hotel, St. Paul, July 9 and 10 with other members of the organization. The board will meet on December 7.

An act of still greater importance was the decision to appoint a committee to revise the association's constitution and by-laws. This revision will provide (1) for one director from each state instead of the present plan of one director from each of numerous arbitrarily designated districts, and (2) for some new plan of membership dues to supplant the present schedule based on output.

The decision to hold the convention in December was made in order to increase attendance and to give producers an earlier opportunity to inspect new machinery at the exhibit before the period of the usual winter shut-down.

Executive Secretary V. P. Ahearn offered his report from which the following excerpts are taken:

*Federal-Aid Highways*—In a bill which encountered only a scattering opposition Congress adopted and the President signed a bill authorizing appropriations for various forms of Federal-aid highway construction during the fiscal years 1938 and 1939. The amounts appropriated for each of the fiscal years, and the purposes for which they are allocated, are set out below:

| | |
|---|---|
| Federal-aid highways | $125,000,000 |
| Forest highways, roads and trails | 14,000,000 |
| Roads over public and Indian lands and federal reservations | 2,500,000 |
| Roads and trails in national parks and other areas under control of National Parks Service | 7,500,000 |
| National Parkways | 10,000,000 |
| Improvement of roads across Indian reservations | 4,000,000 |
| Farm-to-market roads | 25,000,000 |
| Elimination of grade crossings | 50,000,000 |
| Total | $238,000,000 |

The act permits the use of Federal funds without matching by the states in those instances where states are using for highway purposes all their income from gasoline taxes, motor-vehicle license taxes, and other taxes assessed against the users of highways, but are still unable to meet Federal grants in whole or in part.

In the expenditure of $50,000,000 each year for the elimination of grade crossings there is no requirement that the Federal funds shall be matched by the states. The money is to be distributed among the states on the basis of one-half for population, one-quarter for Federal highway mileage, and one-quarter for railway mileage.

*State Highway Surveys*—Highway planning surveys are now in progress or soon will begin in 36 states, according to the Bureau of Public Roads of the U. S. Department of Agriculture. The surveys are being conducted by the state highway departments with the cooperation of the bureau. . . .

In the past attention has been centered on improving the main through highways. In the future more attention must be given, highway officials say, to improving secondary and feeder roads and to improving conditions where the main highways pour their traffic into cities. At the same time the main highways must be maintained and further improved to meet needs that already exist, particularly as regards safety. . . .

*Safety Contest.*—Convincing proof that the safety program in ours and related industries is showing results beneficial to ourselves and to the public, is found in the report of the National Safety Council that the quarry industry, in which the sand-and-gravel industry is grouped, had an accident-frequency rate in 1935 which was 27 per cent. below the rate for 1934, and an accident-severity rate in 1935 which was 53 per cent. below that of the preceding year. This improvement compares with reductions of 10 and 11 per cent. in corresponding rates for all industries. In a report of thirty major industries, the quarry industry ranks twelfth in frequency and twenty-first in severity.

The report of the U. S. Bureau of Mines concerning the results of the annual safety contest in 1935 conducted among the members of the National Sand & Gravel Assn. shows a larger number of participating companies than in 1934. There is an even larger enrollment for the current year. But please let me emphasize again my deep conviction that there is no valid reason why every member of the association should not take an active part in these safety contests. This statement is not based on any appeal to sentiment or to altruism, but may be predicated solely on the basis that the individual operator will find an economic advantage in using this means for the improvement of safety and for the elimination of accidents in his plant. It is axiomatic in our industry that a plant managed with due regard for safety is inevitably efficient in other regards. Let me urge an increasing interest in the safety contest, because this general question will assume even more important proportions in the future. Industry has made a splendid record during the last twenty-five years in attacking the problem of safety, but much remains to be done and nothing can be accomplished unless safety is ingrained in the minds of the executive.

*Silicosis.*—The National Sand & Gravel Assn. was invited to participate in a conference on the silicosis problem, held under the auspices of the U. S. Department of Labor. It will be recalled that during the operation of the code our industry and associated industries adopted standards of safety and health. These standards, the only ones approved for any industry by the National Recovery Administration, commanded widespread interest and approval, with particular reference to their provisions for elimination of dust diseases. . . .

There is no known cure for silicosis. Those industries with a dust problem must interest themselves in preventing silicosis, but even as to prevention the engineers and the doctors are not in complete agreement. But all are apparently prepared to subscribe to the policy that any industry with a dust problem should not engage a worker who might be exposed to dust without first subjecting him to a physical examination by a competent doctor. If any sign of dust infection is thus made evident, the worker should not be placed in a position where his own health will be endangered and where the health of his fellow employees will be prejudiced. It is also recommended that men exposed to dust should be given at least one physical examination a year, because silicosis, if detected in its early stages, is neither disabling nor fatal, and the health of the worker can be protected by transferring him to a place of employment where there is an absence of dangerous dust.

In the last session of Congress an investigation was launched which plunged the country into a condition of mass hysteria over silicosis. The public was led to believe that a heartless industry had sentenced its workmen to a slow and awful death. The National Conference on Silicosis will have the effect, in my judgment, of developing the true facts regarding the problem of dust in industry. Four committees of the Conference are now at work on particular phases of the subject: on the Prevention of Silicosis through Medical Control, on the Prevention of Silicosis through Engineering Control, on the Economic, Legal, and Insurance Phases of the Silicosis Problem, and on the Regulatory and Administrative Phases of the Silicosis Problem. The appointment of these committees apparently had the effect of forestalling any further prosecution of the silicosis question by a committee of the House of Representatives. This association is represented on the Economic, Legal, and Insurance Committee, and it will play its part in the preparation of the final reports of the committees.

On the whole, occupational diseases are not included in the workmen-compensation insurance laws of the various states, but there are exceptions to that rule. There are many who believe that it will ultimately be to the advantage of industry to have occupational diseases included within the compensation laws and therefore they suggest that industry should concern itself in the drafting of intelligent amendments to the state laws. A notable success was registered in Illinois where a law was drafted by representatives of industry, labor and the insurance companies, and passed by the Illinois legislature without serious opposition. The problem is essentially one for the states to handle in so far as direct regulation is concerned, for apparently it lies outside the jurisdiction of the Federal government to go beyond a program of coöperation with the states in solving the problem of dust hazards in industry. I recommend that this subject be given intensive and continued study by the board of directors, to the end that our industry may not be burdened with exorbitant and crippling compensation insurance rates by arbitrary classification of our operations as an industry with a dangerous dust hazard.

*(Continued on page 69)*

# PIT AND QUARRY Special

## CEMENT-MILLS SECTION

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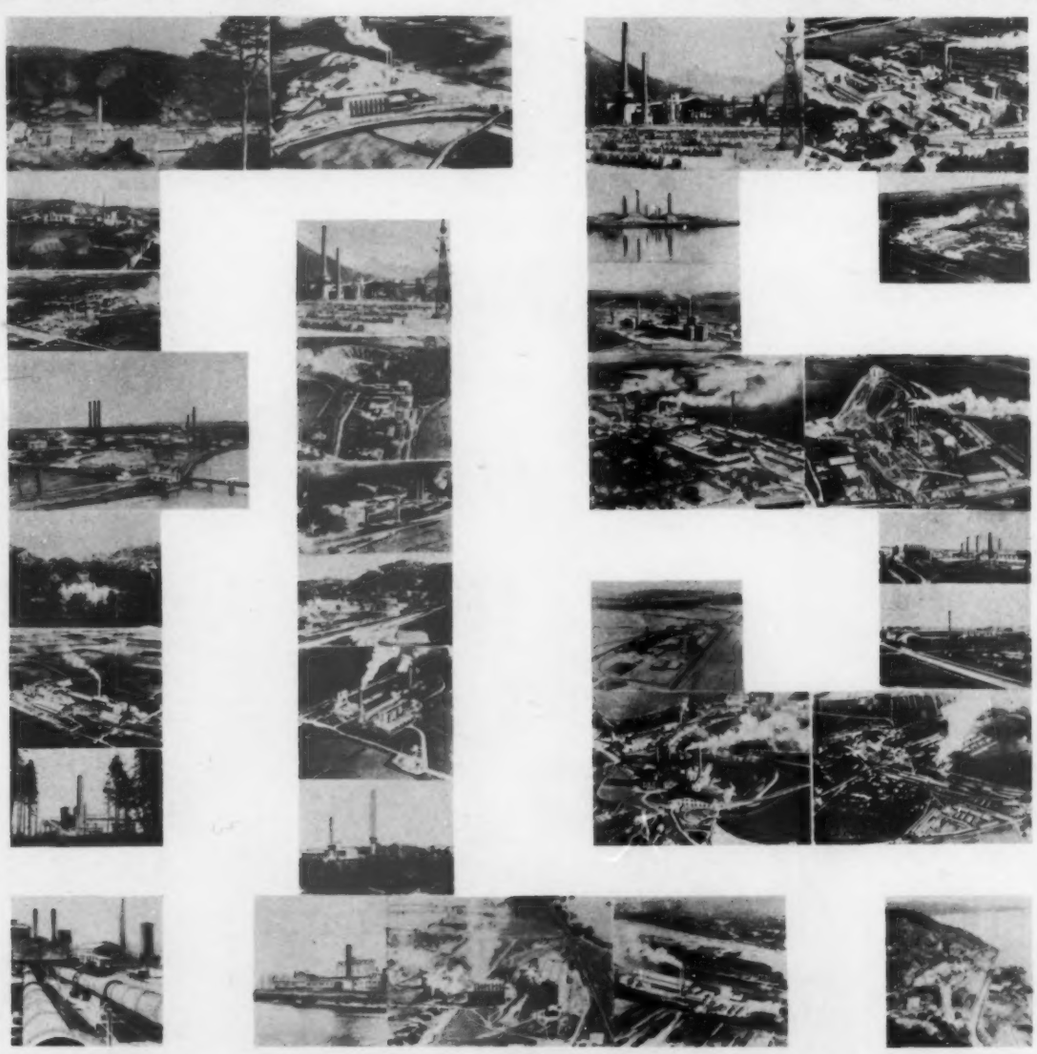

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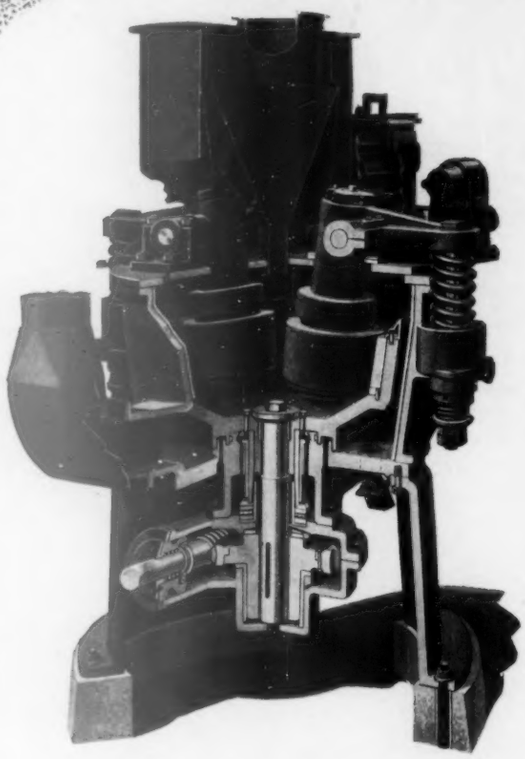
# BOWL MILL *Economy*



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THERE'S proof in performance—and the widespread success of the Bowl Mill is confirmed by the operating records from Raymond installations on direct-fired rotary lime kilns and cement kilns.

One plant reports an increase in lime-to-coal ratio from 2¼: 1 up to more than 3: 1 while using cheaper coal.

Another finds that total savings will pay for the installation in the first six months. Other leading operators are able to show impressive figures on:

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Important savings in power
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The proven economy of the Bowl Mill also applies to general purpose grinding operations in closed circuit with the Raymond Mechanical Air Separator, as shown in the diagram.

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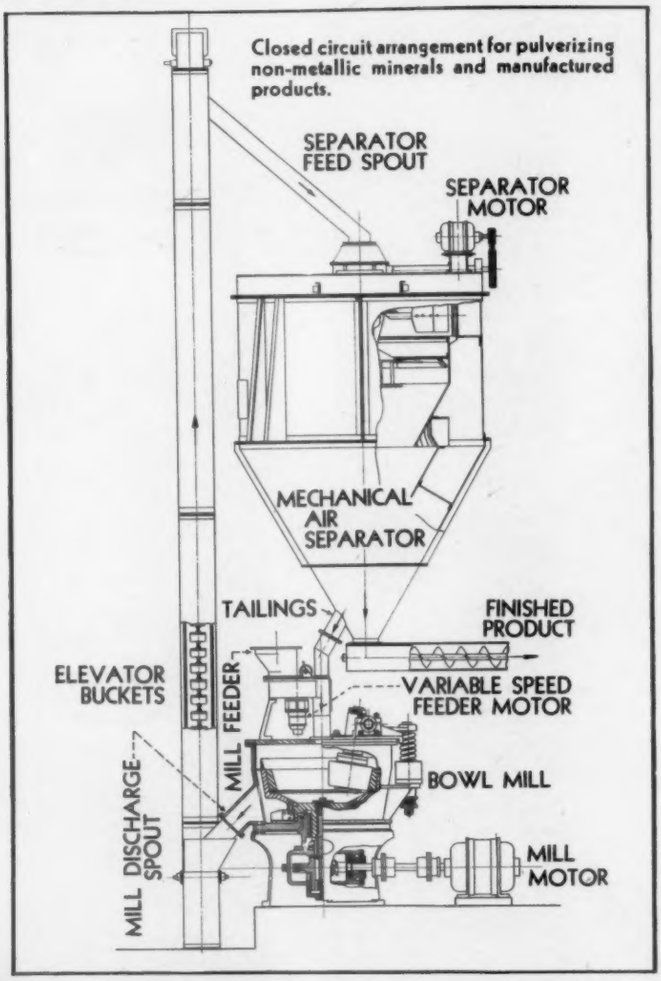


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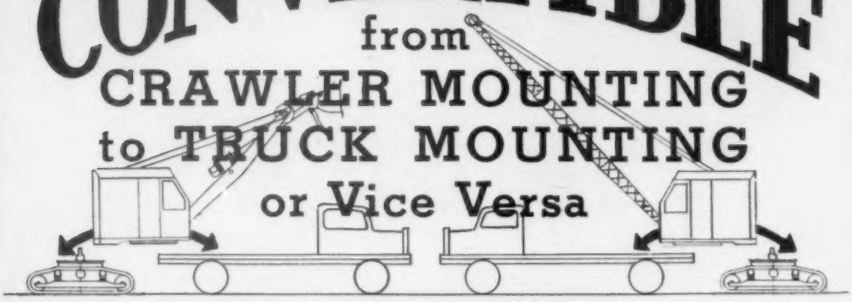

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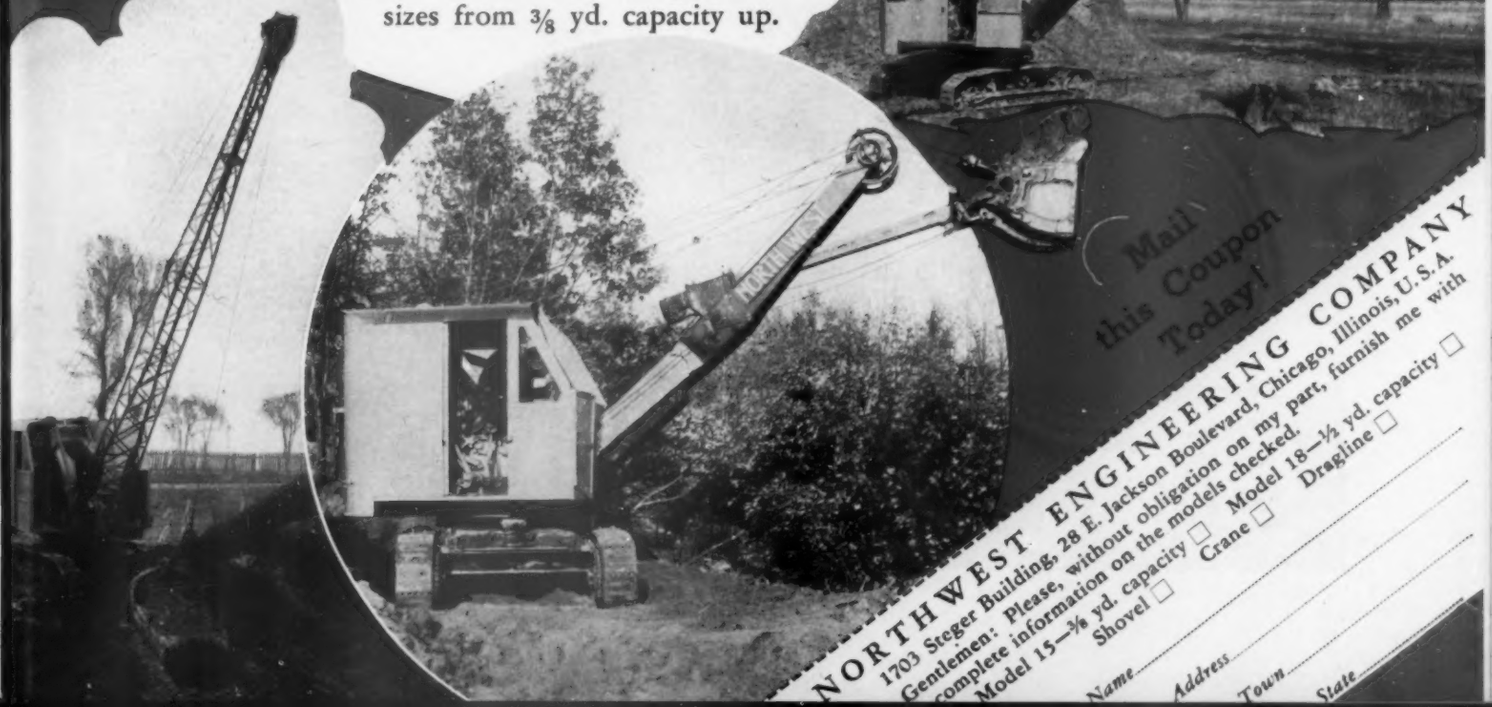

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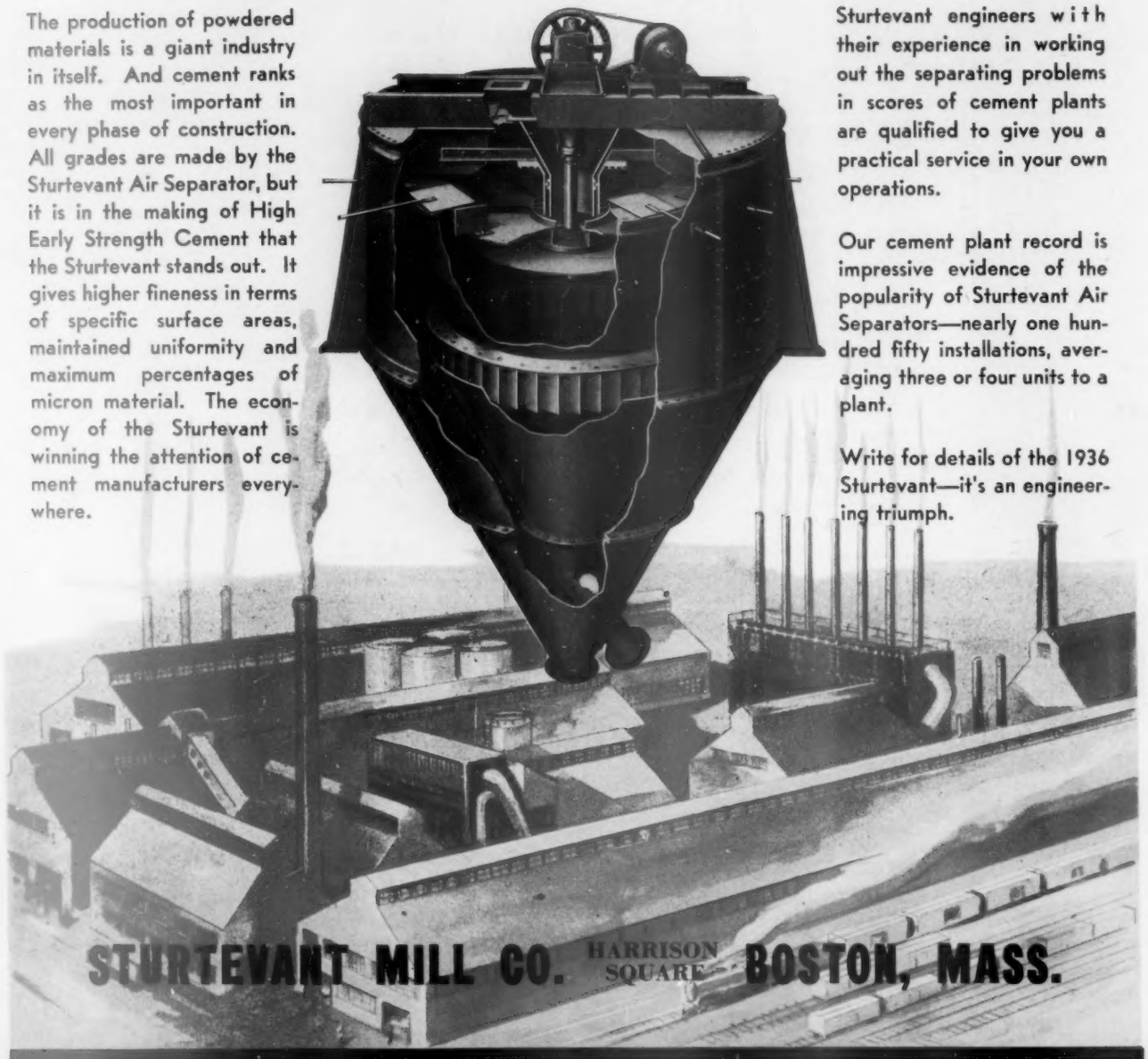

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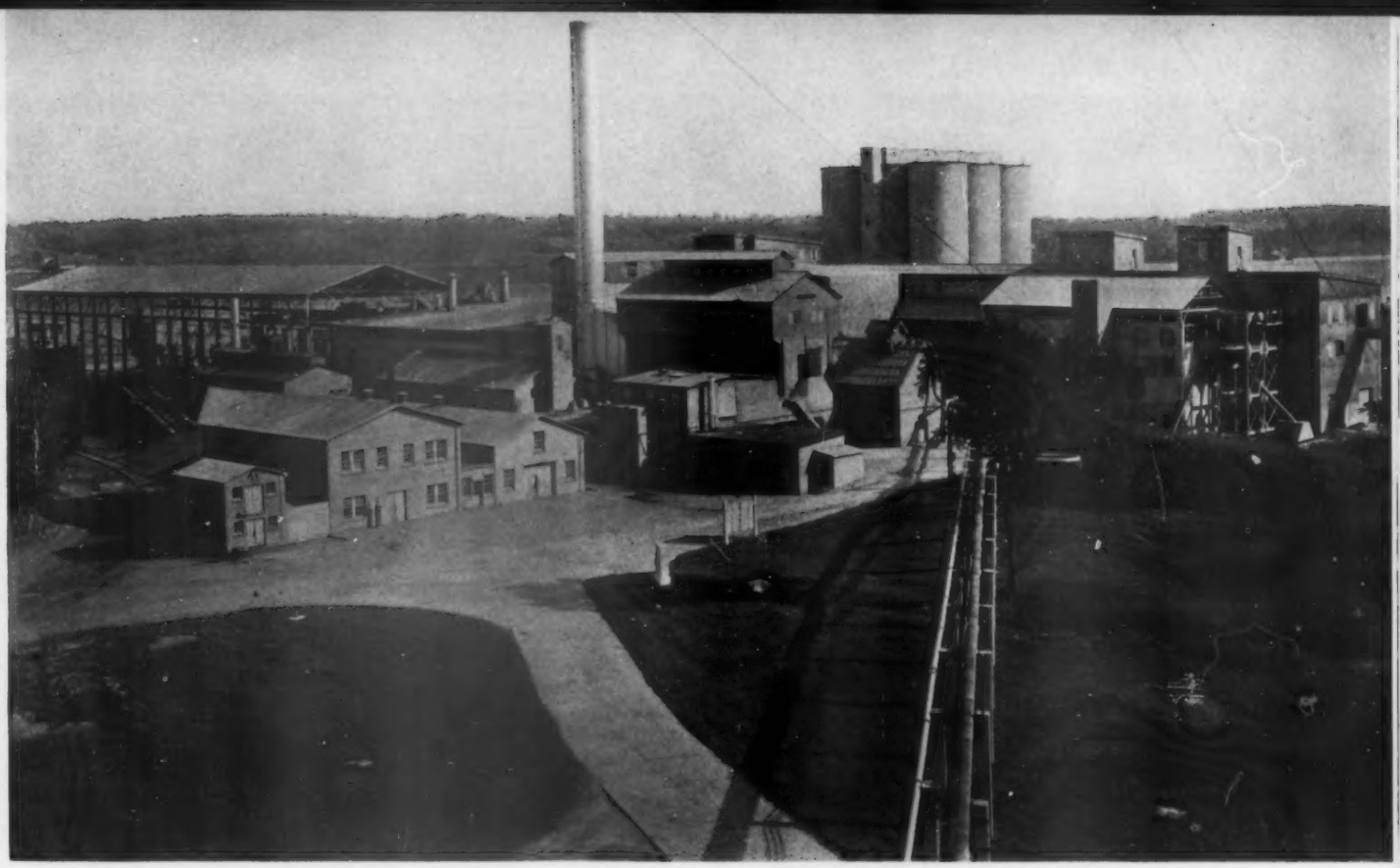


Plant of Alpha Portland Cement Co. at Cementon, N. Y. Steam pipe from waste-heat boilers to power plant in foreground, tramway from quarry at right.

# Alpha Mill at Cementon, N. Y. Rebuilt for Efficiency

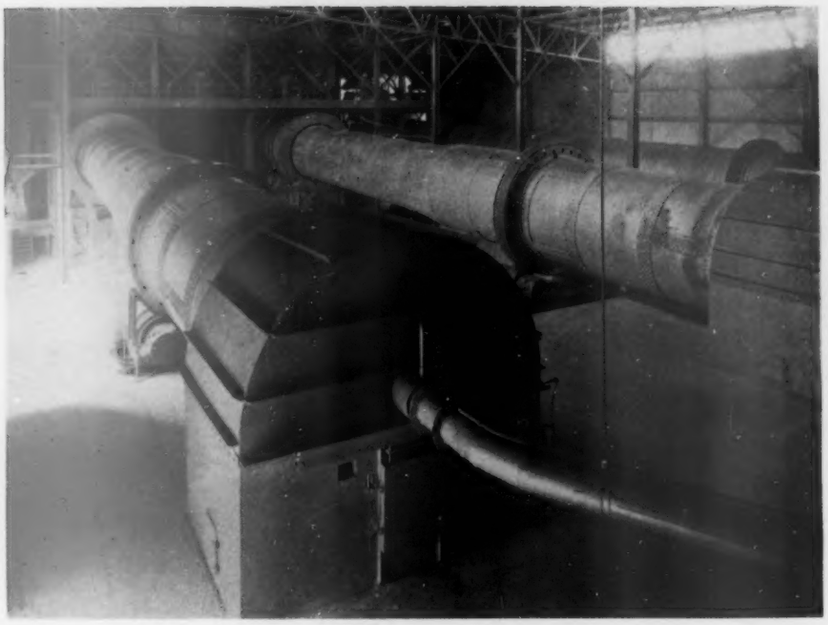
THE Alpha Portland Cement Co., Cementon, N. Y., has completed the second step in what is probably one of the most important improvement programs ever undertaken at a cement plant. With the exception of the coal-grinding and packing departments this is now practically a new plant. More than a year of operation since completion of this program has demonstrated a marked increase in the efficiency and economy of operation of this plant. It is a tribute to the foresight of the management and to the skill of the engineering department of this company that the rebuilt plant is almost as compact as if an entirely new plant had been erected from the ground up.

The last important change, begun late in 1933 and completed early in the summer of 1934, consisted of a complete rebuilding of the raw-grinding and kiln departments, and included other improvements. A single new ball-bearing pulverizer replaced two ball- and four tube-mills formerly used for raw grinding. A separator was installed in closed-circuit and an automatic feeder was added. Two of the three 8-ft. by 135-ft. kilns were rebuilt with enlarged burning zones and shaker-type clinker coolers were installed, the increased capacity of these kilns replacing two 6-ft. kilns which were removed. A previous important step was the rebuilding and relocation, during the winter of 1932-33, of the stone-crushing and stone- and clay-drying departments. The new equipment installed included two rotary driers, a hammer-mill and a pug-mill.

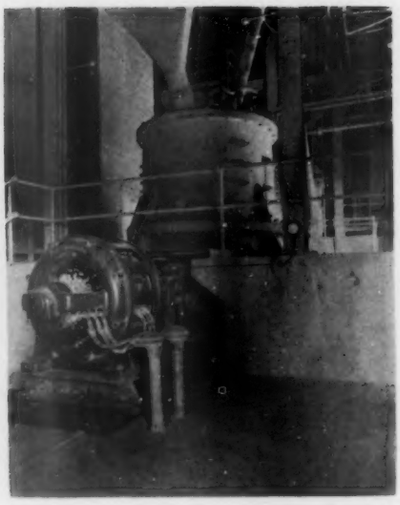
This plant is said to have been the first to use a waste-heat boiler of modern type. Two 750-hp. Edgemoore boilers were installed in 1916 and a third, of 1,189 hp., in 1926. A Cottrell 200,000-cu.ft. per min. electric precipitator, which removes the dust from the flue gases, was also installed in 1916. In 1920 the old-style plates used in this precipitator were replaced with the present type of concrete plates. In 1930 concrete cement-storage silos were erected.

The quarry has both high- and low-lime stone strata, and a rough mix is made when loading this stone. The usual methods of open-pit drilling and blasting are followed, and blasting is done in single-row well-drill shots. Three Marion electric shovels, two No. 37 and one No. 70, load the stone into cars, which are hauled by a Vulcan gasoline locomotive to the foot of an incline up which they are pulled one at a time by an electric hoist. At the top of this incline two Jeffrey Type GDM, Class 30 mine-type electric locomotives haul the cars to the plant incline. A barney car hoists the quarry cars to the Kennedy-Van Saun gyratory primary crusher. Crushed stone is stored in bins of 2,000-ton capacity. Side chutes discharge it from storage into the buckets of an American Steel & Wire Co. cable tramway, which carries the stone to the cement plant. This cableway is 4,800 ft. long between terminals, and has a drop of 200 ft. to the unloading terminal and a capacity of 150 tons per hr. It operates at a speed of 160 ft. per min. and has sixty 1-ton buckets. About one-third of the cableway at the loading end has an inclosed angle of 120 deg. with the remainder of the cableway. This loading end is

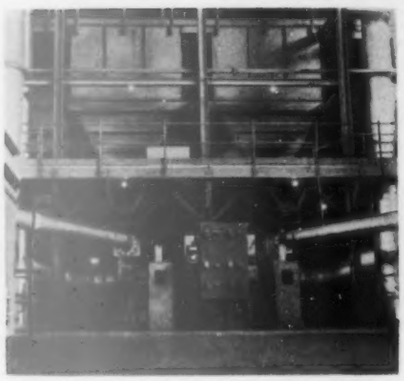
• By W. E. TRAUFFER



The three rotary kilns viewed from firing ends. The two at left have enlarged burning zones.

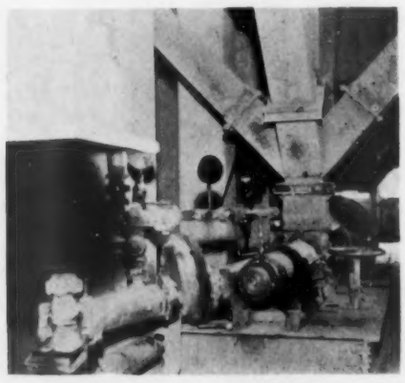


The raw-material pulverizer with its 600-hp. direct-connected motor in foreground.



Part of kiln firing floor showing central board and coal feeders, bins and blowers.

## EQUIPMENT IN ALPHA'S PLANT AT CEMENTON



The two rotary driers used to reduce moisture content of stone and clay.

One of the three 8-in. pumps mounted on rails which move cement from silos to packhouse.

The ball-bearing type raw material pulverizer in closed circuit with separator above.

designed so that it can be swung around to reach any part of the deposit when the present workings run out. The cableway crosses a main highway and a branch-line railroad. Nets are placed at these points and at the discharge end for protection.

The clay pit is about 1,000 ft. from the plant. Loading is done by electric shovel into cars hauled by electric locomotive. The deposit is a 20-ft. bank of clay in what was formerly the old river bottom.

At the cement plant the cableway buckets automatically discharge the stone into hoppers of 50-ton capacity.

Cableway buckets being loaded at quarry crushing plant.

A Jeffrey pan-feeder takes the stone from these hoppers to a Dixie hammer-mill having a capacity of 200 tons per hr. when reducing 6-in. stone to 1-in. minus. The material discharged from the hammer-mill goes to a Christie 8½-ft. by 65-ft. indirect, reverse-flow rotary drier, which reduces the moisture content of the stone to about 0.2 per cent.

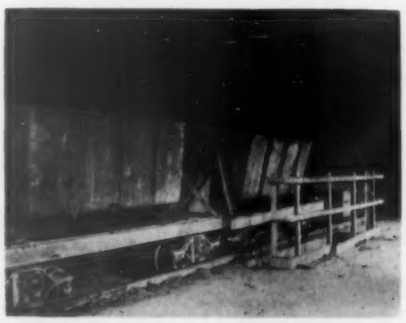
The clay is dumped from the cars into a track hopper that feeds a Lancaster Granulator or pug-mill, which discharges to a second Christie drier similar to the one used for stone. The raw clay has a moisture content varying from 35 to 50 per cent. which is

The hammer-mill which reduces 6-in. stone to 1-in. size.

reduced in the drier to 2 per cent. Each drier discharges into an individual bucket-elevator. The clay is discharged from the clay elevator on a rotary screen, which removes balls over

One of the electric quarry shovels at foot of incline to crushing plant.

1½-in. in size to a car for the return of this material to the pug-mill. The stone elevator and clay screen discharge to a Bethlehem double drag-chain conveyor. Both chains are driven from a common countershaft and can discharge either to storage or to bins over the raw-grinding mill. Individual drag-chains reclaim clay and stone from



Cars of clay hauled by electric trolley locomotive ready for dumping at plant.

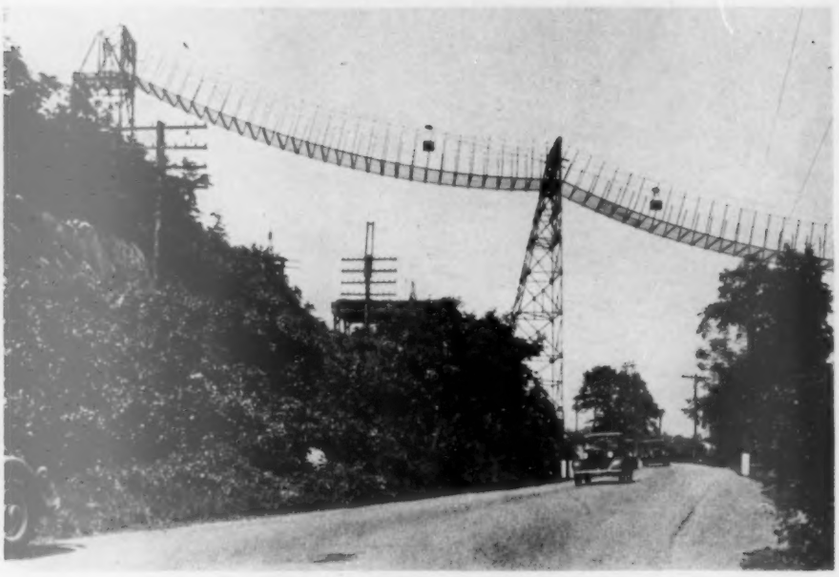
storage and discharge them into bucket-elevators which feed them by means of the original double drag-chain to the mill-feed bins.

Two Richardson Convey-o-Weigh scales operating in combination automatically weigh, proportion and feed the clay and stone to the raw-grinding mill. These machines are of dust-proof design and of the steel-apron type. Normally both will be in use, discharging measured quantities of stone and clay simultaneously, but occasionally, when no admixture of clay is required, the stone Convey-o-Weigh will operate alone. The latter has an hourly capacity of from 18 to 45 tons and weighs the stone in 500-lb. batches. The clay Convey-o-Weigh can add from 10 to 100 lb. of clay or from 2 to 20 per cent. of the weight of the stone, in order to get the desired mix.

Because of variations in the grindability of the raw mix it was found advisable, automatically to vary within certain limits the amount of feed of material to the B & W pulverizer used for raw grinding, as the best results are obtained with this mill when it is neither overloaded nor starved. The rate of feed, in other words, varies according to the load on the pulverizer motor. To meet this condition variable-speed d.-c. motors are used on the two weighers, each motor being controlled by a rheostat and the four rheostats being so connected together that major changes in the rate of delivery of the four conveyors can be effected manually by turning a single knob. For minor variations up to 20 per cent. a G. E. relay will reflect these fluctuations in motor load through the rheostats to the weigher-conveyor motors. An automatic safety device can stop the entire machine if failure occurs on either side.

A common-discharge hopper receives

Pan feeder which discharges stone from hopper to hammer-mill.



Wire net which protects traffic on state highway from any stones which might drop from cableway buckets.

the streams of stone and clay from the Convey-o-Weighs and minimizes any slight unevenness in delivery to the mill which might arise from the short intervals between weighings. A fluted-roller feeder at the hopper outlet is chain-driven from a motor-operated speed-reducer which is included in the automatic speed-variation control. While not intended as a measuring device, this feeder retards the delivery of a batch to the mill sufficiently to allow the next batch to catch up to it and insure a continuous feed to the mill. The Convey-o-Weighs are entirely inclosed and are connected with a dust-collector system.

The 66-in. Babcock & Wilcox Type B pulverizer operates in closed circuit with a 16-ft. Sturtevant mechanical air-

Discharge end of cableway at cement plant. Clay receiving trestle at right.

separator. A bucket-elevator takes the ground raw material to the kiln-feed bins. For the year 1935 the mill showed an average output of 33.2 tons of raw material per operating hr. These figures do not include the flue dust from the dust-collector and waste-heat boiler hoppers which was returned to the mill without passing over the scales. This mill takes care of plant requirements with time to spare, grinding to a fineness of 90 per cent. through 200-mesh.

The mill is driven by a 600-hp. motor and showed an average power consumption of 12 kw.-hr. per ton of raw material ground. Assuming 2 kw.-hr. per ton for the elevator and

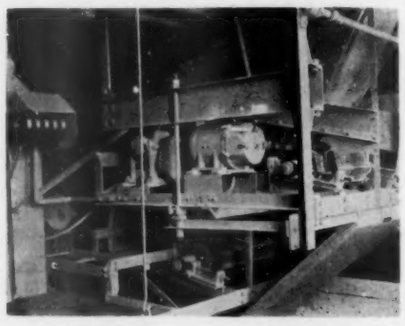
The bins which receive finished cement and pumps which feed to silos.

separator, the power rate was 14 kw.-hr. per ton; or, 4.4 kw.-hr. per bbl.

The two Allis-Chalmers shaking-grate clinker coolers installed under the two rebuilt kilns have 3½-ft. by 35-ft. grates and are rated to cool 50 bbl. of clinker per hr. each to a temperature within 40 deg. F. of the inlet or room temperature. These coolers are similar to those previously installed in the plant of the Arkansas Portland Cement Co., Okay, Ark., but have more grate area per bbl. of clinker cooled and use about 50 per cent. more air. A grizzly at the discharge end of each cooler scalps out all the clinker over 2 in. in size, which is too large for the finish-mill feeders. This clinker is reduced by a roll-crusher before going to the mill-feed bins. About 10 per cent. of the clinker has required crushing.

The coolers discharge to a series of two collecting drag-chain conveyors. Clinker can be conveyed in either direction by using the upper or lower levels of these chains as desired. Ordinarily the clinker is discharged into a bucket-elevator feeding another drag-chain, which discharges the clinker to storage or to the finish-grinding mill-feed bins. Individual feed screws take it from the bins to the 7-ft. by 24-ft. two-compartment Compeb mills. The covered clinker-storage building has a capacity of 125,000 bbl. A Shepard overhead crane with a 3-cu.yd. bucket distributes the clinker to storage and reclaims it to the mill-feed bins.

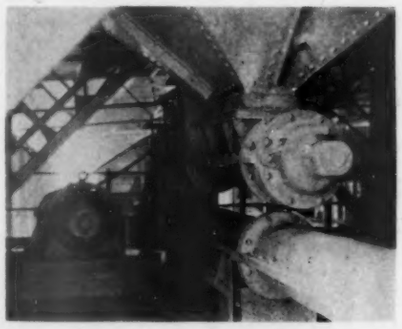
Two 7-in. Fuller-Kinyon pumps handle the cement from bins to the cement-storage silos. The nine silos and their six interstices, which have a total capacity of about 150,000 bbl., were erected by the Macdonald Engi-



The conveying weighers which automatically proportion materials to raw mill.

neering Co. They are located about 400 ft. from the pack-house on the Hudson River bank because the subsoil near the river is unstable and a rock foundation was necessary. Three 8-in. Fuller-Kinyon pumps mounted on cars reclaim the cement from storage through five outlets under each silo and pump it to the pack-house. The cement is sacked by four 4-spout Bates

*(Continued on page 41)*



One of the raw material kiln screw feeders with drive at left.

# The Lime-Saturation Index of Portland Cement

By JOHN SHIPMAN

**FOR business reasons the author of this discussion prefers that it appear under a nom de plume. He is the physical chemist at a large cement mill in the Lehigh District, highly regarded in the industry for his studies and research in the technique of cement manufacture. Basing his conclusions on the findings of Bogue, Lea and Parker he offers genuine assistance toward solving the problem of lime saturation.**

EVER since the classical memoir of Le Chatelier[1] published in 1883 numerous formulæ have been proposed for the calculation of the maximum lime content in Portland cement. Many of these expressions have been based on theoretical deductions concerning the chemical compounds in Portland-cement clinker, while others have been based entirely upon manufacturing practice.

It will be recalled that Le Chatelier's work revealed that the essential constituents of Portland cement are tri-calcium silicate and tri-calcium aluminate. For this reason the formula proposed by this investigator was:

$$\frac{CaO + MgO}{SiO_2 + Al_2O_3} = 3.$$

The above expression is based on the molecular ratios of the oxides and not the weight percentages.

Edwin C. Eckel[2] has proposed a different expression and assumes that the iron oxide forms the compound 2 CaO. $Fe_2O_3$. It further assumes that the silica forms the tri-calcium compound and the alumina the di-calcium compound. According to this authority the magnesia is hydraulic and hence may replace the lime. The formula is:

$$CaO + 1.4\ MgO = 2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3.$$

More recently Dr. Hans Kühl[3] in connection with some detailed experimental work has also adopted the foregoing expression as indicative of the lime saturation, although this author does not consider the magnesia as a hydraulic compound in normal Portland cement. His formula follows:

$$CaO = 2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3.$$

It is now generally agreed that the essential compounds in normal clinker, assuming equilibrium, are 3 $CaO.SiO_2$, 2 $CaO.SiO_2$, 3 $CaO.Al_2O_3$, and 4 CaO. $Al_2O_3.Fe_2O_3$. For the most part these compounds are formed provided that the conditions for cooling are satisfactory. In the investigating of the quaternary system $CaO\text{-}SiO_2\text{-}Al_2O_3\text{-}Fe_2O_3$ Lea and Parker[4] have shown that improper cooling of clinker will result in the formation of a glass or small amounts of 5 CaO. 3 $Al_2O_3$.

As a result of this investigation the following expression has been offered:

$$CaO = 2.80\ SiO_2 + 1.18\ Al_2O_3 + 0.65\ Fe_2O_3.$$

In the application of this formula it is assumed that all the lime combines to form an equilibrium product. It is quite similar to either of the above expressions.

*Silica-Saturation Modulus.*—The writer has made some detailed calculations concerning the use of the lime-saturation index. His results are essentially empirical but to some degree theoretical, being based to a great extent on the compound composition as calculated by the Bogue method and the modified Lea and Parker and author's corrections.

It is generally assumed in all lime-saturation formalæ that the silica combines with the lime to form 3 $CaO.SiO_2$ or $C_3S$, having a molecular weight ratio of 2.80. So far as our present knowledge of cement clinker is concerned we know that this is only barely possible theoretically even under controlled laboratory conditions of comparatively coarse grinding and improper burning and cooling. This is best explained by means of the curve shown in Fig. 1. In this graph is shown the plot of the relationship between the Lime ÷ Silica Factor and the Silica-Saturation Modulus. The Lime ÷ Silica Factor is obtained by assuming that the silica combines with the lime to form $C_3S$ and $C_2S$, the magnitude of the factor depending upon the amount of the $C_3S$ and $C_2S$ present.

In a mix of 100 per cent. $C_3S$ the factor will reach a maximum of 2.80 and represents the maximum amount of lime that can combine with the silica, thus:

$$3 \times 56.08 \div 60.06 = 2.800.$$

On the other hand the minimum amount of lime that can combine with the silica to form 100 per cent. $C_2S$ is 1.867, thus:

$$2 \times 56.08 \div 60.06 = 1.867.$$

Between these two extremes we have a variation of combinations depending upon the amount of $C_3S$ and $C_2S$ present.

In the construction of the curve the following formula was developed:

Let X = percentage of $C_3S$
and 100 — X = percentage of $C_2S$

Hence $2.800\ X \times 1.867\ (100 - X)$ = Lime ÷ Silica Factor or

$$0.933\ X + 1.867 = \text{Lime} \div \text{Silica Factor}, \quad (1)$$

By plotting various values of $C_3S$ and the corresponding values of $C_2S$ in equation (1) against the Silica-Saturation Modulus as represented by the ratio $\times \div (100 - \times)$ or $C_3S \div C_2S$, we have the curve as shown.

Curve I of Fig. 1 considers the normal range of Portland cement up to and including the region of high-early-strength mixes. Curve II is merely a continuation of Curve I but with different ordinates. Because of the nature of the relationship chosen, the curve becomes asymtotic at 2.800 and approaches infinity as a limit with a maximum of $C_3S$.

As previously indicated, it is impossible to attain this maximum of $C_3S$ under normal manufacturing conditions. Indeed it is very doubtful whether it would even be desirable from a practical standpoint. It has been pointed out by others [5] that although $C_3S$ produces early high strength it is the function of the $C_2S$ to carry on the increasing strengths after 28 days. Much has been written about this point and it seems without purpose to repeat these opinions. However, it seems fitting to call attention to the fact that from a practical standpoint the maximum factor in commercial high-early-strength Portland cements is about 2.70.

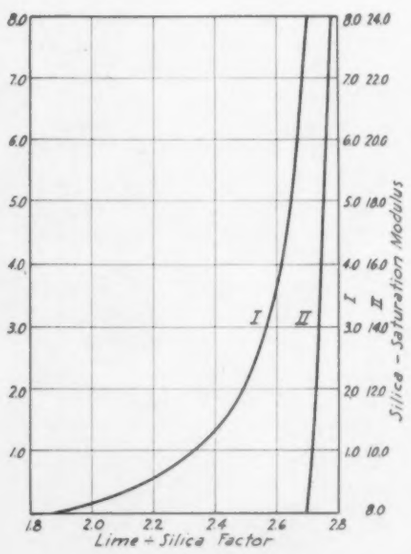



Fig. 1

By means of the Bogue method of calculation the compound composition would be about 65 per cent. $C_3S$ and 10 per cent. $C_2s$. This analysis may compare quite favorably with some present high-early-strength cement, but aside from that point it represents about the ultimate in commercial cement. More frequently high-early-strength cements will be found which have compound compositions of 55 per cent. $C_3S$ and 11 per cent. $C_2S$ corresponding to a Lime ÷ Silica Factor of 2.65.

With a little inspection of the curves of Fig. 1 it will be seen that the maximum lime saturation for the silicates depends upon the ratio of the $C_3S$ and the $C_2S$. The amount of lime available for this combination is of another magnitude and can be considered only after the alumina and iron have formed their respective compounds of $C_3A$ and $C_4AF$, and in addition to these compounds $C_5A_3$, when the ratio of $Al_2O_3 \div Fe_2O_3$ is greater than 1.7, as pointed out by Lea and Parker.

With the introduction of the Bogue method [6] for the calculation of the potential compound composition the general formula has been offered as follows:

$$CaO = A\,SiO_2 + B\,(Al_2O_3 - 0.638\,Fe_2O_3) + C\,Fe_2O_3, \quad (2)$$

where A = 2.800 for a maximum of $C_3S$,

B = 1.65 for a maximum of $C_3A$, but decreases in value for an increase in the $Al_2O_3 \div Fe_2O_3$ ratio,

C = 1.40 for a maximum of $C_4AF$ provided that the $Al_2O_3 \div Fe_2O_3$ ratio is greater than 0.638.

By means of the above expression it is possible to maintain a factor of 1.000 for all mixes provided due account is taken of the desired combinations of the silicates, aluminates and ferrites. This applies equally well in normal Portland-cement mixes as well as high-early-strength cements, although the silica factor in the high-early-strength mixes will be necessarily higher than in the normal mixes.

From the previous discussion of the combination of the silica and lime it will be seen that the following general formula applies:

$$\text{Silica Factor} = 0.933\,X + 1.867,$$

where X = percentage of $C_2S$ in the total silicates.

Table I indicates the Silica Factor for varying percentages of $C_3S$ and $C_2S$. As a basis of comparison it is assumed that the total silicates in the cement (not clinker) is about 75 per cent.

In connection with the Silica Factor there seems to be an optimum point.

Table I.—LIME ÷ SILICA FACTOR

| Percentage | | Compounds | | Ratio | Silica Factor |
|---|---|---|---|---|---|
| $C_3S$ | $C_2S$ | $C_3S$ | $C_2S$ | $C_3S \div C_2S$ | |
| 0 | 100 | 0 | 75 | 0 | 1.867 |
| 25 | 75 | 19 | 56 | 0.333 | 2.100 |
| 50 | 50 | 37 | 37 | 1.000 | 2.334 |
| 75 | 25 | 56 | 19 | 3.000 | 2.567 |
| 90 | 10 | 67 | 8 | 9.000 | 2.707 |
| 100 | 0 | 75 | 0 | Inf: | 2.800 |

This opinion is merely conjectural and is based upon no scientific data. If we solve the foregoing equation for X, thus:

$$0.933\,X + 1.867 = X \div (1.00 - X)$$

it will be found that the two sides of the equation are equal for X at 71.7 per cent. of $C_3S$ and that the Silica Factor becomes 2.536. This corresponds to a compound composition of about 54 per cent. $C_3S$ and 21 per cent. $C_2S$. With sufficient fineness a cement of this composition would make an ideal high-early-strength Portland cement having good high-early-strength properties and also a sufficient amount of $C_2S$ to carry on the increasing strengths after 28 days without retrogression. This is merely offered as an opinion and awaits approval upon further proof.

*Alumina-Iron Oxide Modulus.*—Lea and Parker have modified Bogue's method of compound composition to include the formation of $C_5A_3$ and the subsequent alteration of the other compounds except $C_4AF$. As pointed out by these authors the manufacturing conditions of burning Portland-cement clinker are not ideal for the attainment of complete equilibrium but rather the compounds are formed independently as the liquid produced during the burning process starts to freeze with the consequent separation of the solid phases.

If the cooling is too rapid, such as water quenching, the solid phases do not separate, but the liquid formed at the burning temperatures freezes solid to a glass having little or no hydraulic properties. In the normal production of cement clinker quenching does occur to a limited extent, depending upon the mechanical difficulties in and about the kiln room. In some plants the quenching occurs when the water is deliberately forced on the hot clinker in order to protect the conveying mechanism from the intense heat. Under such conditions only the outside of the balls of clinker become quenched with the consequent formation of a skin of glass and other true chemical compounds. As the internal heat from the clinker evaporates the moisture, the heat from the inner core as it approaches the surface causes the glass again to approximate the liquid state and thence the separation of the solid phases. The amount of reliquefaction is of course dependent upon the initial temperature of the clinker prior to quenching and the amount of water used. It will be recalled that this is analogous to the heat treatment of iron and steel. Air quenching also causes the formation of a glass but not to the extent of water quenching. On the other hand the formation of $C_5A_3$ would be more emphasized in view of the more or less rapid cooling on the surface of the balls of clinker followed by reheating and tempering and consequently the separation of the solid phases without the attainment of complete equilibrium.

From a technical standpoint it has been shown [5] that $C_5A_3$ exhibits higher strengths than similar mortar specimens of $C_3A$. This seems to be borne out in practice in view of the fact that reports from some cement plants have indicated better quality clinker and higher strengths with an air-quenched product than formerly experienced with the normal clinker cooling. On the other hand, studies by numerous investigators [7, 8, 9] on the problems of clinker cooling show that water quenching produces a slightly inferior product, although the plasticity and workability appear to be improved. In these same studies in connection with the grinding of the clinker it has been found that air-quenched clinker grinds quite easily while water-quenched clinker crushes readily but extremely fine grinding requires more power than either normal cooling or air quenching. It might be mentioned that the grindability studies were conducted with 200-mesh screens as an indication of fineness rather than the more acceptable surface-area relationships.

As pointed out by Lea and Parker, the formation of $C_5A_3$ depends upon the temperature of burning and the chemical composition in so far as the alumina and ferric oxide are concerned. From the writer's work on the problem of lime saturation it would appear that these modifications would hold regardless of the temperature of burning. With cements of a high $Al_2O_3 \div Fe_2O_3$ ratio and using the value of 1.65 for B (see equation 2), the lime saturation would indicate a value less than 1.000 even though the "free lime" were more than indicated by incomplete burning. This seems hardly possible in view of the fact that research has proved that cements with a lime saturation of 1.000 will contain no "free lime," assuming equilibrium.

In using Lea and Parker's modified values of compound composition, as well as the author's corrections, the writer found that B varied from 1.65 for a low $Al_2O_3 \div Fe_2O_3$ ratio to 1.262 for a cement containing no $Fe_2O_3$. Since the $C_4AF$ is not altered by the Lea and Parker method, the value of C remains the same at 1.40 for all percentages of $Fe_2O_3$ down to and including an $Al_2O_3 \div Fe_2O_3$ ratio of 0.638, at which point all the $Al_2O_3$ forms $C_4AF$ and no $C_3A$. Beyond this limit the excess $Fe_2O_3$ forms $C_2F$ and $C_4AF$. Research in the high $Fe_2O_3$ and low $Al_2O_3$ field has shown that $C_2F$ is of low cementing value and hence is not desirable in Portland cements although it has potential possibilities in connec-

tion with high-iron cements where the $C_2F$ is considered in solid solution with $C_4AF$. The modified lime saturation in this high-iron range is given as follows:

$$CaO = A\,SiO_2 + 2.2\,Al_2O_3 + 0.7\,(Fe_2O_3 - 1.566\,Al_2O_3), \quad (3)$$

where A = Silica Factor, as previously indicated.

*Lea and Parker Corrections.*—As a result of the investigation of the *Quaternary System CaO-$Al_2O_3$-$SiO_2$-$Fe_2O_3$ in Relation to Cement Technology*, by Messrs. Lea and Parker it has been shown that Bogue's method of potential compound composition should be modified to include the formation of $C_5A_3$ in addition to the other compounds, viz. $C_3S$, $C_2S$, $C_3A$, and $C_4AF$. In the development of the formula by these authors it was assumed that the $C_3S$ was increased at the expense of $C_3A$ which was partially converted to $C_5A_3$. The equations were calculated from analyses of the liquid composition at certain temperatures. Since these analyses are subject to error it may be seen that the corrections are also dubious. These corrections are given as follows:

(a) $C_4AF$ = No correction
(b) $C_3S$ = 1.79 X — 2.77 Y
(c) $C_3A$ = 1.59 X — 2.49 Y decrease
(d) $C_5A_3$ = 1.16 X — 1.79 Y
(e) $C_2S$ = 2.09 Y — 1.39 X,

where X = percentage of $Al_2O_3$ and
Y = percentage of $Fe_2O_3$.

Lea and Parker have shown that the correction to the Bogue method of potential compound composition applies to cements having an $Al_2O_3 \div Fe_2O_3$ ratio greater than 1.7 or less than 6.06. This seems hardly possible since the value of $C_5A_3$ would still be greater than zero. According to the equation $C_5A_3 = 1.16\,X - 1.79\,Y$, the value of X would necessarily be equal to 1.544 for the absence of the compound.

*Author's Corrections.* — From a knowledge of the atomic weights it is possible to approximate the above equations in a similar manner as outlined by Bogue. This is done as follows:

| | | | |
|---|---|---|---|
| CaO | = 56.08 | $C_3A$ | = 270.18 |
| $Al_2O_3$ | = 101.94 | $C_5A_3$ | = 586.22 |
| $Fe_2O_3$ | = 159.68 | $C_4AF$ | = 485.94 |

$C_4AF = 485.94 \div 159.68 = 3.043\ Fe_2O_3$
$C_3A = 56.08 \times 3 \div 101.94 = 1.650\ Al_2O_3$
$C_5A_3 = 56.08 \times 5 \div 101.94 \times 3 = 0.917\ Al_2O_3$

$(159.68 + 101.94) \div 159.68 = 1.638$ parts of $Al_2O_3$ to 1 part of $Fe_2O_3$

$(159.68 + 101.94) \div 101.94 = 2.566$ parts of $Fe_2O_3$ to 1 part of $Al_2O_3$

Hence:
$1.638\,X - 2.566\,Y$ = Decrease in $C_3A$
$1.638 \div 0.9169 = 1.786\,X$
$2.566 \div 0.9169 = 2.799\,Y$

Hence:
$1.786\,X - 2.799\,Y$ = Increase in $C_2S$
$1.786 \times 101.94 \div 159.68 = 1.140\,X$
$2.799 \times 101.94 \div 159.68 = 1.787\,Y$

Hence:
$1.140\,X - 1.787\,Y = C_5A_3$

The $C_3A$ content by the Bogue method is:
$2.650\,X - 1.692\,Y$

Therefore the total correction is:
$C_3A = 2.650\,X - 1.692\,Y - (2.566\,Y - 1.638\,X)$
$= 1.012\,X + 0.874\,Y.$

These corrections apply to an $Al_2O_3 \div Fe_2O_3$ ratio greater than 1.566 to Inf. For a ratio of 0.638, the lower limit for normal Portland cement, to 1.566 the compound composition is the same as given by the Bogue method.

As a comparison of the two methods Table II is given.

**Table III.—COMPARISON BETWEEN THE AUTHOR AND LEA AND PARKER CORRECTIONS OF COMPOUND COMPOSITION.**

Author's Corrections

| X ÷ Y | X | Y | $C_4AF$ | $C_5A_3$ | $C_3A$ I | $C_3A$ II | Diff. | $C_3A$ III | Total I | Total II |
|---|---|---|---|---|---|---|---|---|---|---|
| Inf. | 10 | 0 | 0 | 11.40 | 10.12 | 10.12 | 0 | 26.50 | 21.52 | 26.50 |
| 9 | 9 | 1 | 3.04 | 8.47 | 9.98 | 9.98 | 0 | 22.16 | 21.49 | 25.20 |
| 4 | 8 | 2 | 6.09 | 5.55 | 9.85 | 9.85 | 0 | 17.82 | 21.49 | 23.91 |
| 2.333 | 7 | 3 | 9.13 | 2.62 | 9.70 | 9.70 | 0 | 13.47 | 21.45 | 22.60 |
| 1.566 | 6.105 | 3.895 | 11.85 | 0.00 | 9.59 | 9.59 | 0 | 9.59 | 21.44 | 21.44 |
| 1.5 | 6 | 4 | 12.17 | 0 | 9.14 | 9.13 | −0.01 | 9.13 | 21.31 | 21.30 |
| 1.0 | 5 | 5 | 15.22 | 0 | 4.79 | 4.79 | 0 | 4.79 | 20.01 | 20.01 |
| 0.666 | 4 | 6 | 18.26 | 0 | 0.44 | 0.45 | +0.01 | 0.45 | 18.70 | 18.71 |
| 0.638 | 3.895 | 6.105 | 18.58 | 0 | 0 | 0 | 0 | 0 | 18.58 | 18.58 |

Lea and Parker Corrections

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Inf. | 10 | 0 | 0 | 11.60 | 10.60 | 10.60 | 0 | 26.50 | 22.20 | 26.50 |
| 9 | 9 | 1 | 3.04 | 8.65 | 10.32 | 10.32 | 0 | 22.16 | 22.01 | 25.20 |
| 4 | 8 | 2 | 6.09 | 5.70 | 10.04 | 10.04 | 0 | 17.82 | 21.83 | 23.91 |
| 2.333 | 7 | 3 | 9.13 | 2.75 | 9.76 | 9.75 | −0.01 | 13.47 | 21.64 | 22.60 |
| 1.566 | 6.105 | 3.895 | 11.85 | 0.11 | 9.51 | 9.50 | −0.01 | 9.59 | 21.47 | 21.44 |
| 1.5 | 6 | 4 | 12.17 | 0 | 9.14 | 9.13 | −0.01 | 9.13 | 21.31 | 21.30 |
| 1.0 | 5 | 5 | 15.22 | 0 | 4.80 | 4.79 | −0.01 | 4.79 | 20.02 | 20.01 |
| 0.666 | 4 | 6 | 18.26 | 0 | 0.46 | 0.45 | −0.01 | 0.45 | 18.72 | 18.71 |
| 0.638 | 3.895 | 6.105 | 18.58 | 0 | 0 | 0 | 0 | 0 | 18.58 | 18.58 |

**Table II.—CORRECTIONS TO THE BOGUE METHOD OF COMPOUND COMPOSITION.**

| Compound | Author | Lea and Parker |
|---|---|---|
| $C_3A$ | 1.01 X + 0.87 Y | 1.06 X + 0.78 Y |
| $C_5A_3$ | 1.14 X − 1.79 Y | 1.16 X − 1.79 Y |
| — $C_3A$ | 2.57 X − 1.64 Y | 2.47 X − 1.59 Y |
| Bogue $C_3A$ | 2.65 X − 1.69 Y | 2.65 X − 1.69 Y |

Where: X = Percentage of $Al_2O_3$
Y = Percentage of $Fe_2O_3$

It may thus be seen that a close agreement exists between either method which is well within the limits of experimental error, although as will be presently seen the author's corrections are probably nearer the truth. It is impossible to lay any claims to this statement, but it does appear to have some basis of fact. In the author's corrections the ratio between X and Y is always 1.566 as in the case of the Bogue method of calculation, whereas the Lea and Parker corrections have ratios between 1.544 and 1.552. The 1.566 in the Bogue method of $C_3A$ and the ratio 1.544 in the Lea and Parker corrections lead the author to determine the reason for the lack of agreement.

As an example of the comparison of the two methods Table III is given showing the compound composition as calculated by the Bogue method with the Lea and Parker corrections and the author's modifications.

As an example let us consider a mix having the following composition:

$Al_2O_3 = 8.00$ $Fe_2O_3 = 2.00$ $Al_2O_3 \div Fe_2O_3 = 4.00$
$2 \times 3.043 = 6.09\ C_4AF$

*Lea and Parker Method*

$1.16 \times 8 = 9.28$ $1.59 \times 8 = 12.72$ $2.65 \times 8 = 21.00$
$1.79 \times 2 = 3.58$ $2.47 \times 2 = 4.94$ $1.69 \times 2 = 3.38$

$C_5A_3$ 5.70 — $C_3A$ 7.78 $C_3A$ 17.82
7.78

$1.06 \times 8 = 8.48$
$0.78 \times 2 = 1.56$ + $C_3A$ 10.04

$C_3A$ 10.04

*Author's Method*

$1.14 \times 8 = 9.12$ $1.638 \times 8 = 13.10$ $2.65 \times 8 = 21.00$
$1.787 \times 2 = 3.57$ $2.566 \times 2 = 5.13$ $1.69 \times 2 = 3.38$

$C_5A_3$ 5.55 — $C_3A$ 7.97 $C_3A$ 17.82
7.78

$1.012 \times 8 = 8.10$
$0.874 \times 2 = 1.75$ + $C_3A$ 9.85

$C_3A$ 9.85

| | | | |
|---|---|---|---|
| $C_4AF$ | 6.09 | 6.09 | 6.09 |
| $C_5A_3$ | 5.70 | 5.55 | |
| $C_3A$ | 10.04 | 9.85 | 17.82 |
| Total | 21.83 | 21.49 | 23.91 |

From an examination of Table III it may be seen that the two methods are in close agreement and well within the limits of experimental error. On the whole the author's corrections are slightly less than those of Messrs. Lea and Parker. Consequently the $C_3S$ content is slightly greater by the former method. Particular attention is called to the column designated as Total I, which includes the summation of $C_3A$, $C_5A_3$, and $C_4AF$, while the column Total II includes the summation of only $C_3A$ and $C_4AF$ as calculated by the Bogue method. It will be seen that in the case of the Lea and Parker

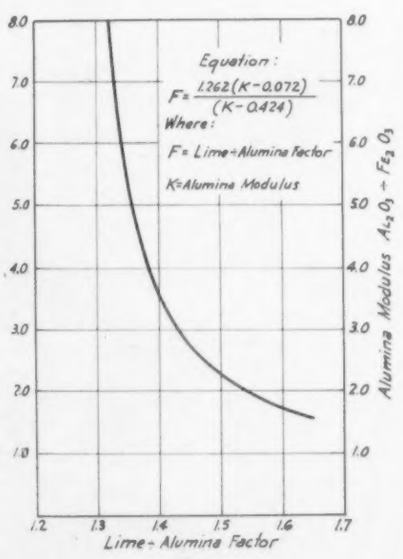



Fig. 2

method there is a steady decrease in the summation of these three compounds with an $Al_2O_3 \div Fe_2O_3$ ratio from Inf. to 1.566, while the author's method indicates a very slight difference over the same range. These calculations have all been carried to the second decimal in order to make a more comprehensive as well as a fairer comparison, although in ordinary practice it is doubtful whether such accuracy is warranted.

*Lime ÷ Alumina Factor.*—In the application of the foregoing principles the calculation of the Lime ÷ Alumina Factor is rather tedious, therefore the following equation and the curve in Fig. 2 are developed.

Let $X$ = percentage of $C_5A_3$,
$100 - X$ = percentage of $C_3A$,
also $0.917\ X + 1.650\ (100 - X)$ = alumina factor.
Therefore,
Percentage $C_5A_3 = C_5A_3 \div (C_5A_3 + C_3A)$,
Percentage $C_3A = C_3A \div (C_5A_3 + C_3A)$,
since $C_5A_3 = 1.140\ A - 1.787\ F$,
$C_3A = 1.012\ A - 0.874\ F$,
where $A$ = percentage of $Al_2O_3$,
$F$ = percentage of $Fe_2O_3$.
Hence percentage

$$C_5A_3 = \frac{1.140\ A - 1.787\ F}{1.140\ A - 1.787\ F + 1.012\ A + 0.874\ F},$$

$$= \frac{1.140\ A - 1.787\ F}{2.152\ A - 0.913\ F},$$

$$= \frac{1.140\ (A - 1.566\ F)}{2.152\ (A - 0.424\ F)},$$

$$= \frac{0.53\ (A - 1.566\ F)}{(A - 0.424\ F)}, \quad (4).$$

Also percentage

$$C_3A = \frac{1.012\ A + 0.874\ F}{1.140\ A - 1.787\ F + 1.012\ A + 0.874\ F},$$

$$= \frac{1.012\ A + 0.874F}{2.152\ A - 0.913\ F},$$

$$= \frac{1.012\ (A + 0.864\ F)}{2.152\ (A - 0.424\ F)},$$

$$= \frac{0.47\ (A + 0.864\ F)}{(A - 0.424\ F)}, \quad (5).$$

Therefore, Lime ÷ Alumina Factor equals:

$$C_5A_3 \times 0.917 + C_3A \times 1.650.$$

$$\text{Percentage } C_5A_3 = \frac{0.53\ (A - 1.566\ F)}{A - 0.424\ F} \times 0.917,$$

$$= \frac{0.486\ (A - 1.566\ F)}{A - 0.424\ F},$$

$$\text{Percentage } C_3A = \frac{0.47\ (A + 0.864\ F)}{A - 0.424\ F} \times 1.650,$$

$$= \frac{0.776\ (A + 0.864\ F)}{A - 0.424\ F},$$

$$\text{Total } C_5A_3,\ C_3A = \frac{1.262A - 0.091\ F}{A - 0.424\ F},$$

$$= \frac{1.262\ (A - 0.072\ F)}{A - 0.424\ F}, \quad (6).$$

Let $K$ = Alumina Modulus.
$= Al_2O_3 \div Fe_2O_3 = A \div F$
Then $A = K\ F$, (7).
Substituting

$$(7) \text{ in } (6) = \frac{1.262\ (K\ F - 0.072\ F)}{(K\ F - 0.424\ F)},$$

$$= \frac{1.262\ f\ (K - 0.072)}{f\ \ (K - 0.424)},$$

$$\text{Lime} \div \text{Alumina Factor} = \frac{1.262\ (K - 0.072)}{(K - 0.424)}, \quad (8)$$

where $K$ = Alumina Modulus $= Al_2O_3 \div Fe_2O_3$

Similar to the Silica Factor there appears to be an optimum point at about 1.63 in which case the Lime ÷ Alumina Factor equals the Alumina Modulus. This again is offered as a problem for consideration and awaits further proof.

**Table IV.—LIME ÷ ALUMINA FACTOR**

| $Al_2O_3 \div Fe_2O_3$ Ratio | Lime ÷ Alumina Factor |
|---|---|
| 0.638 to 1.566 | 1.650 |
| 1.75 | 1.597 |
| 2.00 | 1.543 |
| 2.25 | 1.504 |
| 2.50 | 1.474 |
| 2.75 | 1.452 |
| 3.00 | 1.432 |
| 3.50 | 1.405 |
| 4.00 | 1.385 |
| 4.50 | 1.368 |
| 5.00 | 1.356 |
| 6.00 | 1.340 |
| 8.00 | 1.321 |
| Inf: | 1.262 |

*Summary.*—From the previous discussion it may be seen that the following equations apply:

(I). General Equation:
$CaO = A\ SiO_2 + B\ (Al_2O_3 - 0.638\ Fe_2O_3) + C\ Fe_2O_3$.

(II). Normal Mixes:
$A = 0.933\ X + 1.867$, where X equals the percentage of $C_3S$ in the total silicates.
$B = 1.65$ for an $Al_2O_3 \div Fe_2O_3$ ratio from 0.638 to 1.566, and lower for an increase in this ratio.
$C = 1.40$ for an $Al_2O_3 \div Fe_2O_3$ ratio greater than 0.638.

(III). High-Lime Mixes:
$A = 2.80$ for a maximum of $C_3S$.
B and C are the same as previously indicated.

(IV). High-Iron Mixes: ($Al_2O_3 \div Fe_2O_3$ less than 0.638).
$CaO = A\ SiO_2 + 2.2\ Al_2O_3 + 0.7\ (Fe_2O_3 - 1.566\ Al_2O_3)$.
A = Same as pertains to Normal or High-Lime Mixes.

(V). Optimum Mixes: ("Ideal" Portland Cement)
$CaO = 2.536\ SiO_2 + 1.63\ Al_2O3 + 0.36\ Fe_2O_3$.

The optimum mix indicated above is for consideration from a practical, economical, and theoretical viewpoint.

*Practical Application.*—As a practical application of the foregoing principles let us consider some typical examples. In this discussion the compound composition as estimated by the Bogue method is modified to include the formation of $C_5A_3$ in mixes having an $Al_2O_3 \div Fe_2O_3$ ratio greater than 1.566. In the Bogue method the $Fe_2O_3$ is assumed to combine with the lime and alumina to form $C_4AF$. In this case the $C_4AF$ is found by multiplying the $Fe_2O_3$ by 3.04, thus:

$C_4AF = (224 + 102 + 160) \div 160 = 3.04\ F$
Since $C_4AF + C_3A = 1.344\ F + 2.650\ A$,
it follows that $C_3A = 1.344\ F + 2.650\ A - 3.04\ F$,
or
$C_3A = 2.650\ A - 1.69\ F$.

In considering the modified corrections as given by the author the total $C_3A$ becomes:

$C_3A = 2.65\ A - 1.69\ F + 2.57\ F - 1.64\ A$, or
$C_3A = 1.012\ A + 0.874\ F$.

The $C_5A_3$ content pertains to cements having an $Al_2O_3 \div Fe_2O_3$ ratio greater than 1.566, in which case the compound is given as follows:
$C_5A_3 = 1.14\ A - 1.79\ F$.

The calculation of the $C_2S$ and $C_3S$ follows the general method as outlined by Bogue, after the lime alloted to the $C_4AF$, $C_3A$, and $C_5A_3$ has been taken into consideration. In this respect the lime in the $C_4AF$ is calculated by multiplying the $Fe_2O_3$ by 1.4. The lime in the $C_3A$ and the $C_5A_3$ is not found as easily but the curve in Fig. 2 determines this value with little difficulty. The lime available for combination in the compounds $C_3A$ and $C_5A_3$ is found by subtracting the product of the $Fe_2O_3$ by 0.638. As an example, let us assume that the $Al_2O_3$ in a cement is 5.00 per cent. and the $Fe_2O_3$ is 2.50 per cent.

Hence, $5.00 \div 2.50 = 2.00$, and from the curve, Fig. 2, the Lime ÷ Alumina Factor is 1.543.

Thus:

$C_4AF = 3.043 \times 2.50 = 7.60\%\ C_4AF,$
$= 0.638 \times 2.50 = 1.60\%\ Al_2O_3,$
$= 1.40 \times 2.50 = 3.50\%\ CaO.$
$C_3A + C_5A_3 = 5.00 - 1.60 = 3.40\%\ Al_2O_3,$
$= 3.40 \times 1.543 = 5.25\%\ CaO,$
Total $CaO = 3.50 + 5.25 = 8.75\%\ CaO.$

This is subtracted from the total CaO less the CaO available for CaO. $SO_3$ less the free CaO, and hence the CaO available for the silicates.

Example I:
$CaO = 64.72$ Free $CaO = 2.0$
$Al_2O_3 = 4.95$ $2.25 \times 0.7 = 1.57$
$Fe_2O_3 = 3.30$ 3.57% CaO
$SiO_2 = 19.52$
$SO_3 = 2.25$ $64.72 - 3.57 = 61.15\%\ CaO$
$Al_2O_3 \div Fe_2O_3 = 1.50$ Curve, Fig. 2, $K = 1.65$
$C_4AF = 3.30 \times 0.638 = 2.11\%\ Al_2O_3,$
$= 3.30 \times 1.40 = 4.62\%\ CaO,$
$= 3.30 \times 3.043 = 10.05\%\ C_4AF.$
$C_3A = 4.95 - 2.11 = 2.84\%\ Al_2O_3,$
$= 2.84 \times 1.65 = 4.68\%\ CaO,$
$= 2.84 \times 2.65 = 7.54\%\ C_3A.$
$61.15 - (4.62 + 4.68) = 51.85\%\ CaO$
$C_3S = (4.07 \times 51.85) - (7.60 \times 19.52) = 62.68\%\ C_3S.$
$C_2S = (51.85 + 19.52) - 62.68 = 8.69\%\ C_2S$
$C_3S = 62.68 \div 71.37 = 87.5\%.$
Silica Factor $= 0.933 \times 0.875 + 1.867 = 2.683.$

Hence the Lime-Saturation Formula would be:

$CaO = 2.683\ SiO_2 + 1.650\ (Al_2O_3 - 0.638\ Fe_2O_3) + 1.40\ Fe_2O_3.$

Thus: $63.15 \div (52.25 + 4.68 + 4.62) = 1.026.$

Therefore the foregoing cement is overlimed and hence would indicate a free-lime content of about $(1.026 - 1.000) \div 1.026$ or 2.5 per cent. Although the actual free-lime determination showed 2.0 per cent. or a difference of 0.5, the amount is well within the limit allowed for sound cement. Hence, if the above mix had been designed with a Lime-Saturation Index of 1.000 and with proper grinding, burning and cooling, the cement should have contained 0.5 per cent. free lime.

Example II:
$CaO = 63.80$ Free $CaO = 2.0$
$Al_2O_3 = 6.49$ $2.49 \times 0.7 = 1.75$
$Fe_2O_3 = 2.74$ 3.75% CaO
$SiO_2 = 18.15$
$SO_3 = 2.49$ $63.80 - 3.75 = 60.05\%\ CaO$
$Al_2O_3 \div Fe_2O_3 = 2.37$ Curve, Fig. 2, $K = 1.487$
$C_4AF = 2.74 \times 0.638 = 1.75\%\ Al_2O_3,$
$= 2.74 \times 1.40 = 3.84\%\ CaO,$
$= 2.74 \times 3.043 = 8.34\%\ C_4AF.$
$C_3A = 6.49 - 1.75 = 4.74\%\ Al_2O_3,$
$= 4.74 \times 1.487 = 7.05\%\ CaO,$
$= (6.49 \times 1.012) + (2.74 \times 0.874) = 8.96\%\ C_3A.$
$C_5A_3 = (6.49 \times 1.140) - (2.74 \times 1.79) = 2.50\%\ C_5A_3.$
$60.05 - (3.84 + 7.05) = 49.16\%\ CaO.$
$C_3S = (4.07 \times 49.16) - (7.60 \times 18.15) = 62.14\%\ C_3S.$
$C_2S = (49.16 + 18.15) - 62.14 = 5.17\%\ C_2S.$
$C_3S = 62.14 \div 67.31 = 92.2\%.$
Silica Factor $= 0.933 \times 0.922 + 1.867 = 2.727.$

Hence the Lime-Saturation Formula would be:

$CaO = 2.727\ SiO_2 + 1.487\ (Al_2O_3 - 0.638\ Fe_2O_3) + 1.40\ Fe_2O_3.$

Thus: $62.05 \div (49.50 + 7.05 + 3.84) = 1.027.$

Similarly this cement is also overlimed and would indicate a free-lime content of about $(1.027 - 1.000) \div 1.027$ or 2.6 per cent. As in the former case, the free-lime determination showed 2.0 per cent., or a difference of 0.6 per cent., and also is well within the limit for sound cement, although actually the above cement contains too much free lime for a good sound cement unless the clinker or cement had been seasoned to convert some of the free lime to $Ca(OH)_2$.

Using Bogue's method of compound composition without the Lea and Parker corrections or the author's modifications, the Lime-Saturation Index has a value of 1.042 or about 4.0 per cent. free lime. This is too great for a satisfactory cement and hence the Bogue method may be considered in error for cements having an $Al_2O_3 \div Fe_2O_3$ ratio greater than 1.566.

The foregoing method has been applied to many high-early-strength and normal Portland cements and the same general relationship exists. High-early-strength cements appear to be overlimed, while normal cements are essentially underlimed especially where the free-lime contents are below about 0.8 per cent.

*Conclusion.*—In conclusion it might be stated that, although the foregoing discussion more or less substantiates the theories as developed by Lea and Parker, it is not on the other hand intended as a criticism against the Bogue method of compound composition. Indeed Mr. Bogue should be given a deal of credit for having brought before the cement industry a method whereby the chemistry of cements may be studied and compared with greater precision and foresight than heretofore realized. Just as all great developments are brought about by evolution, each investigator contributing his bit to the ultimate solution of the problem, so Mr. Bogue has made his contribution, but Messrs. Lea and Parker have modified these theories to accommodate some of the practical results obtained and thus these two are also to be congratulated.

The writer desires to take no credit for having developed these formulæ because without the work of Mr. Bogue and more recently Messrs. Lea and Parker this discussion would not have been possible. It is only hoped that the results heretofore stated may lead to a better understanding of the theory and practice of cement manufacture.

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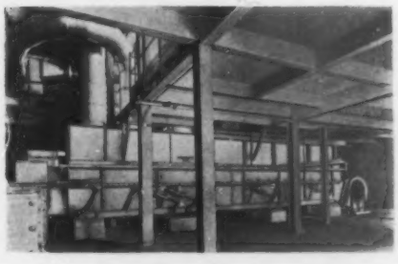
## ALPHA (from page 36

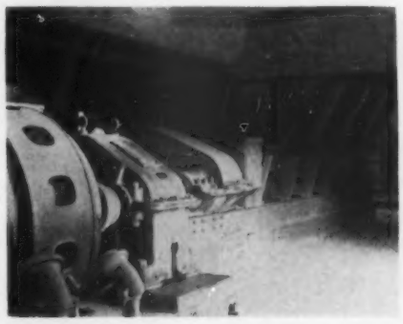
packers. A reversible slat-conveyor for each pair of packers can load on one side of the building into barges and on the other side into cars. A Norblo dust-collector is installed in this building.

Improvements were also made during recent years to the waste-heat boilers and the power-generating plant. The old main waste-heat flue was replaced with one of concrete-and-brick construction. The old 100-deg. superheaters were removed and replaced with 250-deg. Edgemoore smooth-tube superheater elements ahead of the first pass of the boiler. The 3,000-kw. Westinghouse steam-turbine generator, which was erected in 1917, was improved by installing a new steam unit on the same base, retaining the original generator. The former water rate of 17½ lb. was reduced to 12 lb. by this improvement. The steam at 200-lb. pressure is transmitted a distance of 700 ft. through a pipe-line above ground from the boilers to the power-plant. About 40 deg. of steam heat and 10 lb. of pressure are lost in transit. Sufficient power for full-capacity operation of the plant and all dependent operations is generated. An emergency connection with the lines of the Central Hudson Power Co. is maintained.



One of the two shaking-grate clinker coolers.

In the reconstruction of this plant only the most modern types of buildings were erected, the types used depending on existing conditions. The stone and raw-mill buildings have steel frames with Gunite because of poor subsoil. The kiln building has a steel frame with asbestos sheathing. All other new buildings are of concrete or stucco. All new buildings have Federal Haydite roof slabs with waterproof covering. Safety was given first consideration and all the new equipment installed has approved standard safety guards. Every conveyor has a sheet-metal cover and a grating beneath. Most of the elevators are con-



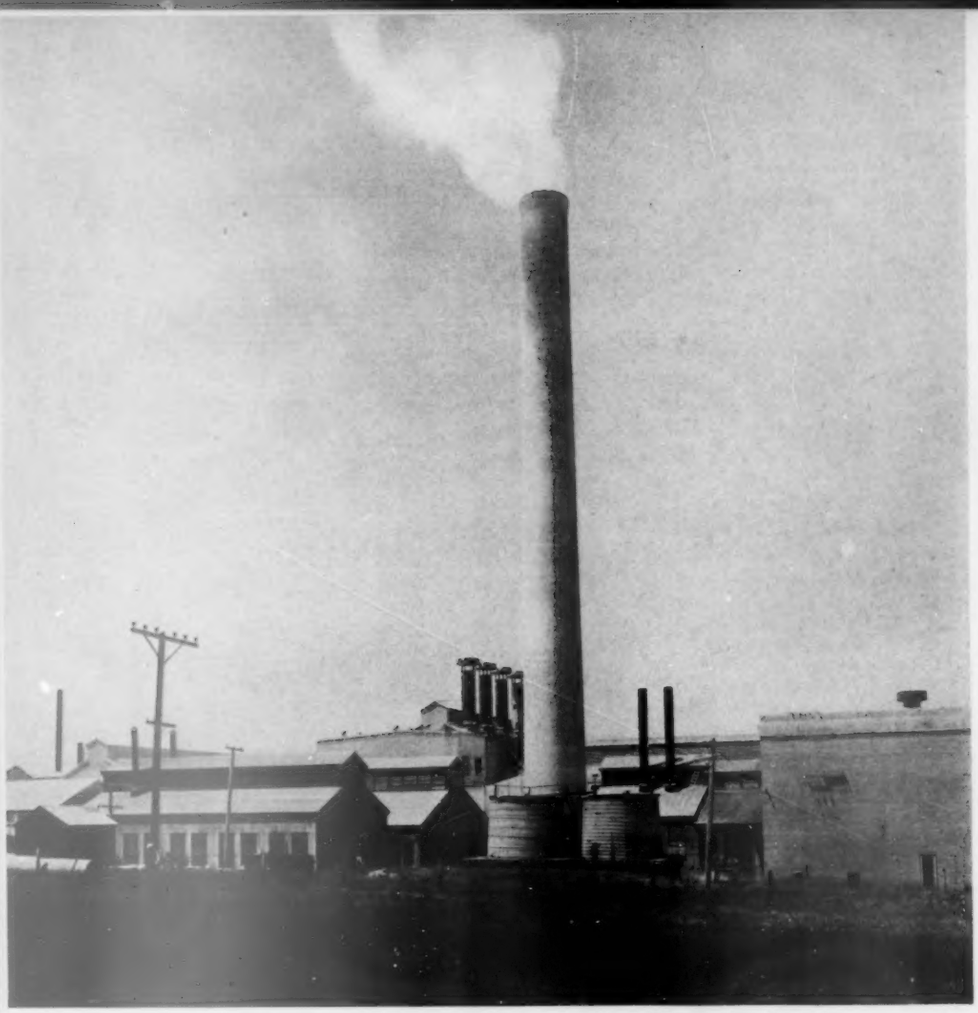
The pug-mill which breaks up clay before going to drier.

crete-inclosed and the others have steel inclosures. Another improvement effected during the winter was the placing of all overhead electric cables underground.

The main Cottrell precipitator collects all the dust from the kiln exhaust fans and waste-heat boilers. The stone raw-mill and kiln buildings are ventilated by individual fans connected to all equipment units, including elevators, conveyors, etc. All these fans discharge to the main precipitator.

## Sales and Value of Talc and Soapstone Increase

Sales of talc and ground soapstone in the United States in 1935 increased 12 per cent. in quantity and nearly 9 per cent. in value over 1934. The average value per ton was also higher. New York continued as the leading producing state, contributing 40 per cent. of the total output of 172,716 tons. Other producing states were Arkansas, California, Georgia, Maryland, New Jersey, New York, North Carolina, Pennsylvania, Vermont, Virginia, and Washington. All states showed substantial gains both in quantity and value of output over 1934. Arkansas entered the list of producers through development of a deposit near Waterloo, Nevada County.



The 235-ft. stack at the Cowell Portland Cement Co. plant.

# Install Electrical-Precipitator System at Cowell Cement Plant

LOCATED on the lower slope of Mt. Diablo, 25 mi. east of Oakland, Cal., the Cowell Portland Cement Co. plant has been in operation since 1907. The gradual development of groves and vineyards in the adjacent country has formed a prosperous community that required relief from the cement dust which for years had escaped from the stacks. When the decision to provide dust-collecting equipment was reached in 1935, a contract for the improvements was placed with the Western Precipitation Co. In addition to a Cottrell electrical precipitator, the contract provided for the design and construction of a new flue system and a concrete stack.

The dry process is used in the Cowell plant which has eight kilns each 7 ft. 6 in. in diameter by 110 ft. long. In the old arrangement the kiln housings were built of brick in a continuous structure with partitions and short stacks making a separate gas passage for each kiln.

The new design called for a separate kiln housing for each kiln delivering the gases to a main flue which is connected to the inlet flue of the Cottrell precipitator. A short breeching joins the outlet flue of the precipitator to a concrete stack.

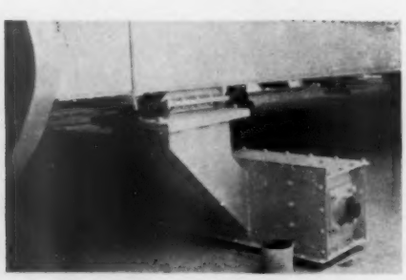
The kiln housings are rectangular in shape with hoppered bottoms and are built of steel plate properly supported by structural-steel members and lined with fire-brick. The lining of the sides, ends and the arched top is 9 in. thick, the hopper bottoms are lined 4½ in. thick. Each of these structures is 13 ft. wide by 26 ft. long and 18 ft. high. The roof arch is built to a radius of 8 ft. 6 in. Six feet from the kiln end of the housing an arched baffle-wall is built across the upper part of the housing and at the middle of the chamber a second baffle wall is carried up from the bottom.

Each kiln housing is connected to the main flue by a short neck consisting of a rectangular unlined steel flue. A damper of Meehanite heat-resisting cast-iron provides a means of controlling the draft to each kiln or shutting it off entirely if necessary.

Between the kiln end and the first baffle wall air-inlet doors are mounted in vertical guides on each side of the housing. Air for the necessary cooling of the kiln gas is drawn in through these openings. It was also planned that the combustion of any unburned gases should be completed here instead of permitting it to occur at some point further along in the flue system where such combustion might prove explosive. Manhole doors are also provided on either side of the second baffle for the admission of additional cold air, if required, and for use in making repairs. A 6-in. screw conveyor attached to the hoppers under each kiln housing is used to remove any dust which may settle there.

The main flue occupies a passageway between the kiln building and the raw-grinding building. The necks at the end of the kiln housing enter the main flue at a right angle and are joined to it in a flexible manner which permits the main flue to expand several inches lengthwise. The top and bottom plates are not attached to the main flue, merely projecting into the opening. On each side of the kiln neck a vertical V-shaped expansion joint connects the end

Looking downward on the main flue.



Tail end of main flue screw conveyor.

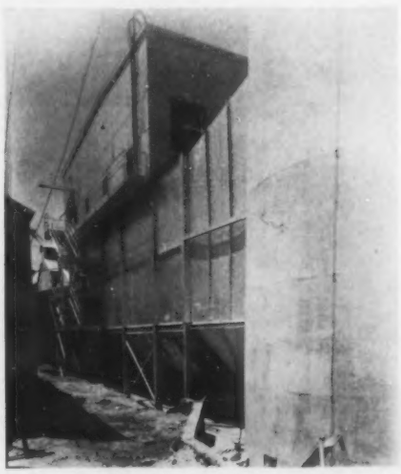
The precipitator operating room. Ends of the collecting electrodes in foreground are rapped by air hammer every hour.

Collecting electrodes "taking the rap." Dust falls into hoppers below.

of the neck with the side of the flue opening.

The main flue is about 150 ft. long. It is 11 ft. wide by 10 ft. 6 in. high for 60 ft. of its length on the north end, then increases uniformly in height to 24 ft. high at the south end where it enters the precipitator. At this point a V-shaped expansion joint is provided. The flue is anchored to its structural supports at the middle point and for the rest of its length is supported on steel rollers and cold-rolled steel plates. The bottom of the flue is a series of inverted pyramid hoppers discharging into a screw conveyor. The top of the flue is elliptical.

The precipitator is of the "rod-curtain" type. In this design rows of ⅛-in. black-iron pipes are supported from horizontal headers to form a series of ducts parallel with the gas flow. The nominal size of each curtain is 8 ft. long by 18 ft. high. The discharge electrodes are ⅛-in. square twisted rods



The new precipitator with base of stack at the right.

View showing the kiln housing.

hanging vertically on the center line of the ducts. A group of these curtains and discharge electrodes is called a section.

The Cowell precipitator consists of two units each having three sections in series, each section being 15 ducts in width. A steel plate multivane damper is located at the inlet and outlet end of each unit.

Electricity for the discharge electrodes is furnished by three sets of equipment assembled in a substation which is located on top of the inlet flue. Each set consists of a single-phase transformer with 5 taps for secondary voltages of 40,000 to 60,000 volts, a mechanical rectifier and a switchboard. High-tension switches are so arranged that each rectifier may be cut out and its load carried by one of the others. The power as delivered to the discharge electrodes is a unidirectional interrupted current. The power consumption is 450 kw-hr. per day.

The collecting electrodes are cleaned by rapping with air hammers every hour. The accumulation of dust in the hoppers beneath the precipitator is removed four times a day by means of two 9-in. screw conveyors running lengthwise of the hopper. A series of slide gates is used to control the rate of feed to the two screws, which discharge into the 12-in. screw conveyor beneath the main flue. This 12-in. screw in turn delivers the dust to the screw conveyor, carrying the raw mix to the feed-bin elevator. The precipitator dust is stored in a separate bin and fed continuously back into the kiln feed bins. The returned dust has had no harmful effect on the production or quality of clinker.

Adequate draft for kiln operation and for friction losses through dampers

Power sub-station located atop the inlet flue.

and flues is easily maintained by the concrete stack on the outlet of the precipitator. This stack is 15 ft. 6 in. in diameter by 235 ft. high and is lined to a height of 100 ft. with hard-burned red brick. It was erected by the Rust Engineering Co. of Pittsburgh, Pa.

Other subcontractors were the Herrick Iron Works of Oakland, Cal., which fabricated and erected the steel, and J. T. Thorpe & Son of San Francisco, who did the brick work on the kiln housings.

# LEHIGH

Plant of Lehigh Portland Cement Co. at Fordwick, Va. with new waste-heat boiler building and stack in background.

THE plant of the Lehigh Portland Cement Co. at Fordwick, Va., one of the first Portland-cement plants in the South, has undergone a series of improvements in recent years which enable it to compete with other plants in its territory both in economy of production and quality of product. This improvement program was completed during the Winter of 1935-36 by the installation of two 1,200-hp. waste-heat boilers, ten clinker-grinding mills, three 14-ft. air-separators, a 275-ft. concrete kiln stack, twelve 1,000-bbl. reinforced-concrete raw-material blending bins, dust-collectors, etc. The power-plant was improved by the addition of an evaporator, a heater, a storage tank, and feed-water pumps. Many new electric motors, Link-Belt bucket-elevators, and screw-conveyors were also installed as well as a clinker drag-conveyor and a clinker crusher. The plant began operations for the year on April 15.

In 1934 a Ross chain-feeder was installed in the rock-crushing department. Other important improvements in recent years included the installation of a 2,500-kw. General Electric turbine-generator and a number of electric motors in 1932. In 1931 a Bradley Hercules mill and two 14-ft. Sturtevant separators were installed in the raw material-grinding department. The plant has a capacity of 2,500 bbl. in 24 hr. and can now produce high-early-strength cement as well.

The quarry from which limestone is obtained was opened in 1926 and is now being deepened about 15 ft. below the present quarry floor which is at ground level. The deposit is tilted at about 20 deg. and has strata of alternate characteristics, varying in hardness and lime content. The overburden averages about 6 ft. in depth and is removed by hand stripping, after which it is loaded into cars by the quarry shovels and hauled away. The face is now about 1,500 ft. long and has a maximum height of 90 ft. which will increase as the quarry is worked farther into the hillside. Drilling is done in benches with jackhammers and steam shovels are used for loading the stone into 10-ton quarry cars. A gasoline locomotive is used in the quarry for switching purposes. The loaded cars are hauled a distance of about 2 mi. to the crushing plant by two steam locomotives.

The shale quarry is about 1 mi. from the plant and in the opposite direction from the stone quarry. Well-drills are used on the 90-ft. face and the shale is loaded into cars by electric shovel. Similar 10-ton cars and steam locomotives haul the shale to the plant. The shale in this deposit is unusually hard and is almost coal black.

The various grades of limestone are rough-mixed in being fed to the 36-in. gyratory primary crusher. A belt-conveyor carries the crushed limestone to a surge bin, a Ross chain feeder controlling the discharge from this bin to a belt-conveyor feeding the hammer-mill. The minus 2-in. rock from this crusher is carried by a series of belt-conveyors and bucket-elevators to six 600-ton stor-

Hoppers under boilers from which dust is collected by screw conveyors.

The preliminary grinding mill in the raw-material grinding department.

The top of one of the two 1200-hp. water-tube type waste-heat boilers.

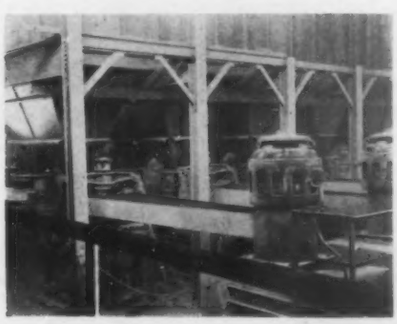
By W. E. TRAUFFER

# MODERNIZES FORDWICK PLANT

Another view of Fordwick plant showing clinker coolers at left.

age tanks. The shale follows the same flow through the crushing plant and is stored in twelve 80-ton steel tanks.

Belt-conveyors under the stone and shale bins feed these materials to a 1½-ton Fairbanks weigh-batcher which has one compartment for each material and is manually operated. A belt-conveyor carries the blended raw material to three 5-ft. by 50-ft. rotary driers which are direct-fired with coal. The dried raw mix is carried by elevator and belt-conveyor to the Hercules mill-feed bin in the raw-grinding department. This mill, which was brought from the company's plant at Oglesby, Ill., in 1930, is equipped with a 5-mesh screen and has a capacity of 42 tons per hr. A screw-conveyor and an elevator system feed the mill product to two 14-ft. separators, the rejects of which are taken by a screw-conveyor and an elevator to



Some of the ten finish-grinding mills with their bins and vertical motors.

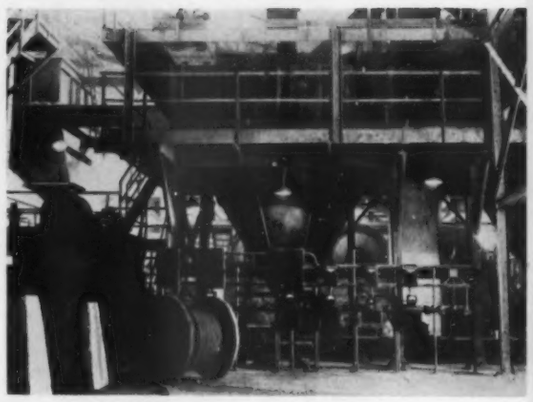
hoppers feeding two Type 18E and one Type 16B F. L. Smidth tube-mills. The tube-mill product is conveyed and elevated to the same separators previously mentioned.

The separator product, which has a fineness of 92 per cent. through 200-mesh, is carried by a series of elevators and screw-conveyors to the 12 new blending bins, which are of reinforced concrete and have a capacity of 1,000 bbl. each. Chemical analysis of the contents of each bin is made when it is full, and the desired blend is obtained in proportioning the discharge from the bins. This is done by means of rotary feeders under the two rows of bins which are chain-driven from a shaft driven through a variable speed-reducer. A series of screw-conveyors and elevators carry the blended raw mix to the kiln-feed bins. Tests of this material are made in transit and if the blend is not satisfactory the discharge from the elevators can be diverted back into the blending bins.

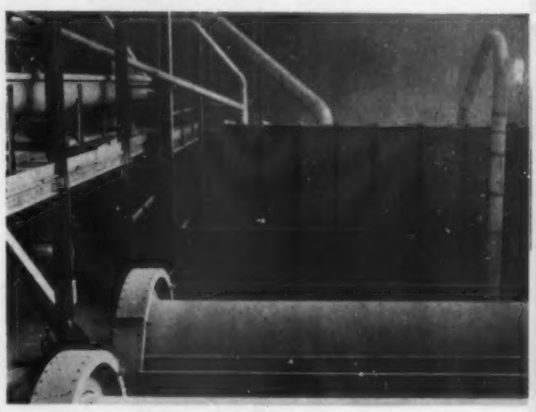
Burning is done in five 125-ft. coal-fired rotary kilns of which three are 7 and 7½ ft. and the other two 9 ft. in diameter. Coal used for firing the kilns is first passed through a double-roll crusher and then through two rotary driers, one 5 ft. by 50 ft. and the other 5 ft. by 30 ft. in size. The dried coal is pulverized by five 30-in. Bradley Griffin mills from which it is conveyed by a screw-conveyor and an elevator to the kiln-feed bins. Screw-feeders discharge it into the kilns.

Each of the five kilns formerly discharged its exit gases through individual dust chambers to individual steel stacks which remain in place and can be used in an emergency. Now all the five kilns discharge their gases to a main flue and two auxiliary flues carry the hot gases to the two 1,200-hp. Babcock & Wilcox waste-heat boilers which operate at 200-lb. pressure. These boilers are of the 3-drum, water-tube type and each is equipped with a Babcock & Wilcox 3-loop superheater designed to superheat the steam 50 deg. Each boiler

Looking up at the new 275-ft. concrete kiln stack. Flue connection at left.



View in raw-grinding department showing the two 14-ft. separators with grinding mills in background.



View in finish-grinding building showing conditions existng before the new dust collector was connected up.

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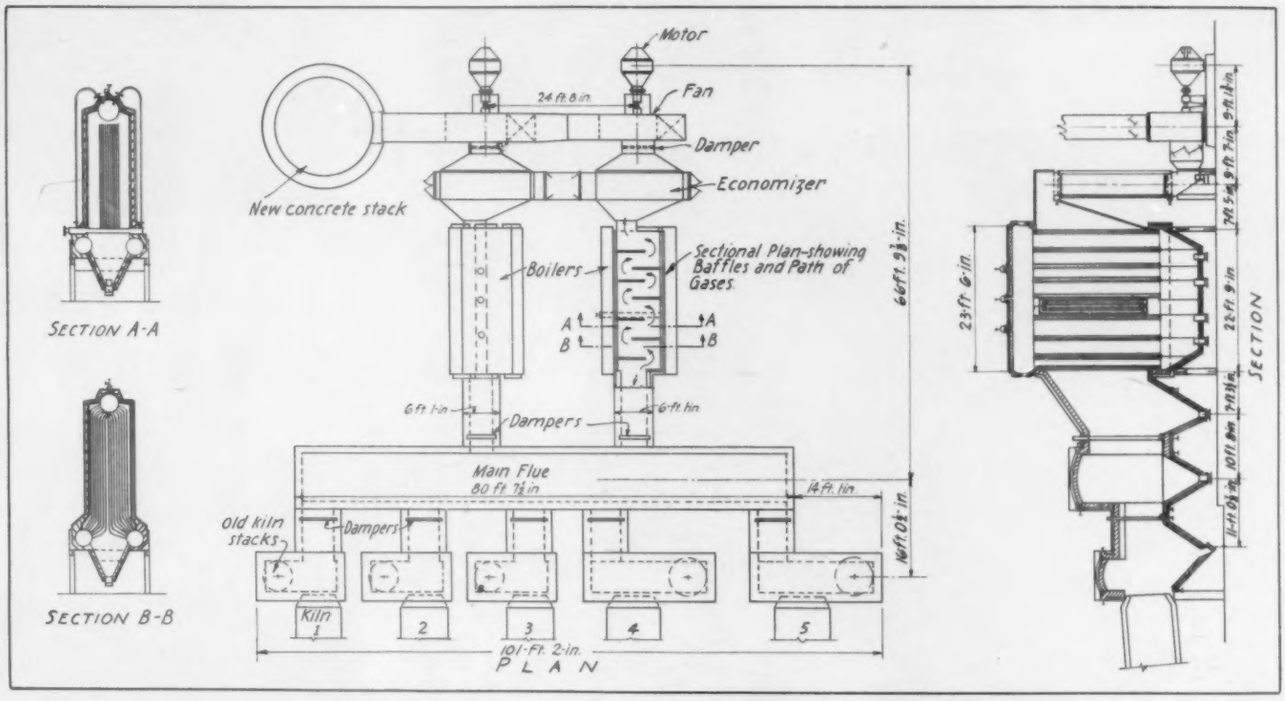


**Plan and cross-section of the new waste-heat boiler installation showing connections to kilns and stack. Note provisions for emergency use of old kiln stacks.**

also has a Babcock & Wilcox return-bend, loop-tube type counterflow economizer with 3,760 sq. ft. of heating surface and a 10-ft. Sturtevant fan which supplies draft for the boilers and kilns. The two fans are direct-driven by 150-hp. variable-speed induction motors.

With only four of the five kilns operating the two waste-heat boilers were producing 60,000 lb. of steam per hr. Temperatures at the boiler inlets are averaging 1,400 deg. F., which is about 125 deg. higher than the kiln-discharge temperature before the boilers were installed. The higher clinker production obtained, however, counterbalances the increased fuel consumption. Temperatures at the boiler outlets average 410 deg. F. and at the economizer outlets 300 deg. F. Draft at the rear of the kilns averages 0.45 in. and at the economizer outlet 4.0 in., the difference being the loss in the system. The kiln draft is automatically kept at any predetermined point by a Bailey automatic draft-control system, one of the first of this type to be installed in the cement industry. The new stack erected in connection with the boiler installation is 275 ft. high with inside diameters of 14 ft. at the bottom and 9 ft. at the top.

The boilers are cleaned by lancing and the economizers by automatic soot blowers. Dust collected in the boilers is taken by screw-conveyors to a tank from which it is blended with the raw material fed to the kilns. This waste-heat system is operated through a main control-board fitted with pressure gages, Bailey fluid meters, a Bailey meter-control system, etc.

The stoker-fired boilers formerly used are replaced by this new system but three of them are to be retained as stand-by units.

The steam leaves the waste-heat boilers at a temperature of 425 deg. F. and with a pressure of 190 lb. Loss in transmission reduces these figures to 415 deg. and 185 lb. at the generating plant. A 2,500-kw. General Electric turbo-generator supplies sufficient power for operation of the entire plant and the electrically-operated quarry equipment. Smaller turbines operate the boiler-feed and water-circulating pumps and a steam-driven compressor also depends on the boilers. Vacuum for the turbines is maintained by a Ross Airjector. Exhaust steam from the auxiliaries goes to a Foster-Wheeler evaporator which evaporates all the raw water necessary for boiler-feed make-up. This system allows only distilled water to go to the boilers, preventing the formation of scale.

(Continued on page 67)

**View in limestone quarry showing irregularity and varying characteristics of deposit. Crew is engaged in shifting track.**

# PULVERIZING
## and CONVEYING Systems
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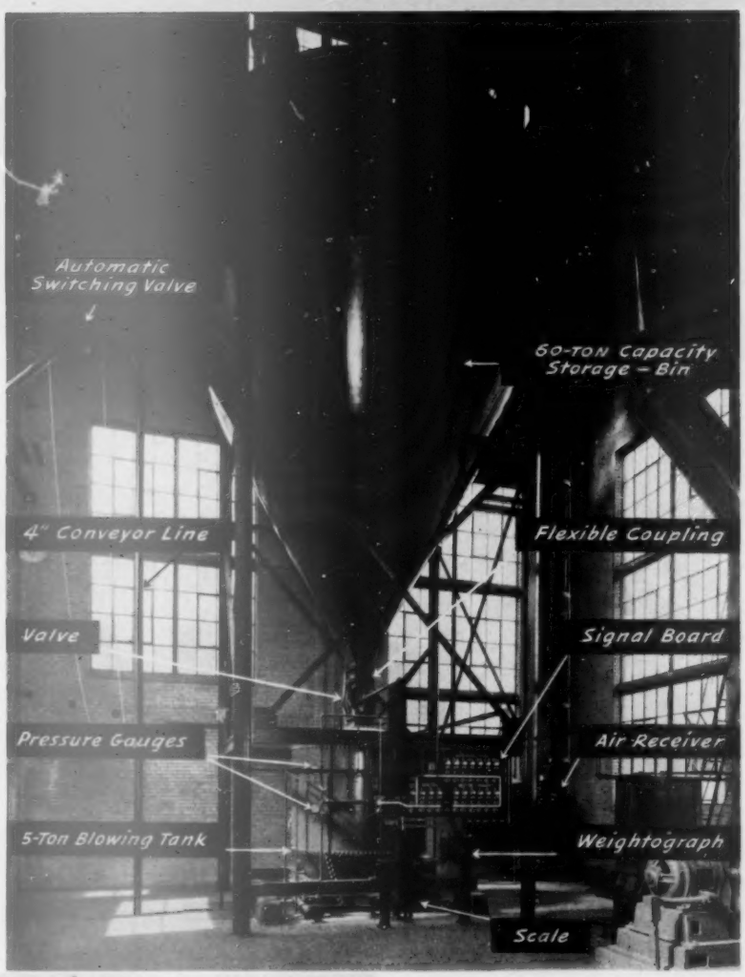

*Whiting 3-yd. bucket crane, 80-ft. span. North American Cement Corp., Catskill, N. Y.*

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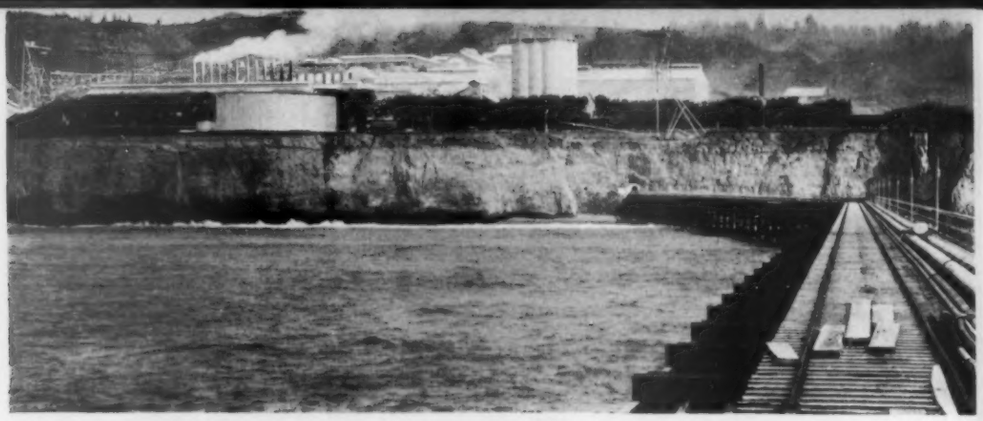
# WHITING

PIONEERS SINCE 1884

By W. E. TRAUFFER



Plant of Santa Cruz Portland Cement Co., at Davenport, Cal., viewed from boat-loading pier.

# Coastwise Cement-Distributing System Served by Self-Unloader

The self-unloading boat "Santacruzcement" which serves the four distributing plants.

THE Santa Cruz Portland Cement Co., which electrified the cement industry of the Pacific Coast late in 1934 with its extensive new system for the distribution of cement by water to the major coast markets, has demonstrated that it made a wise and profitable investment. The foresight shown by the company is all the more remarkable as there was little evidence of the present upturn in business at the time it was definitely decided to go ahead with this program. Markets formerly out of reach because of high freight rates are now open to it and as a result the company's shipments in the last 18 months have been at a much higher percentage of its capacity than that of the West Coast cement industry in general. This record was achieved in spite of the fact that none of the huge construction projects under way in the West during that period were located within ordinarily economical shipping distance or were so restricted that the company was unable to participate in them.

Left—One of the four scraper tunnels showing discharge openings. Scraper and discharge ramp in background.

The plant of the Santa Cruz Portland Cement Co. is the largest and one of the oldest in the far west but has been kept up-to-date through constant improvements so that it can produce cement at least as economically as most of its competitors. There is the further advantage of a large deposit of high-grade limestone near the plant so located that it can be worked by an economical system of glory-holes and with a downhill haul to the plant. The shale used in the mix is also easily accessible and the oil used for fuel is received by water and pumped to the plant through an underwater pipe-line. Descriptions of the quarry and plant operations published in the March 9 and March 23, 1932, issues of PIT AND QUARRY described all these features in detail.

All these conditions have been in the company's favor but in the past it has been handicapped by the fact that water shipments could not be made direct from the plant. Although located on a bluff overlooking the Pacific Ocean at Davenport, about 12 mi. west of Santa Cruz, Cal., the plant was formerly inaccessible by water because of shoals extending nearly half a mile out into the ocean along the entire coast line for many miles in either direction. As a result it was formerly necessary to make water shipments in two stages, a railway trip of about 90 mi. to San Francisco Bay and a water trip to destination. Water shipments to coastal points south of Santa Cruz thus traveled the 90 mi. by train and an additional 100 mi. by boat before passing within sight of the plant on the way south.

Briefly, the new distributing system consists of cement-storage silos at the plant at Davenport from which the cement is pumped through pipe-lines to the self-unloading boat *Santacruzcement* which is moored to buoys within easy reaching distance of the end of a pier extending almost a half-mile out into the ocean. The difficulties encountered in building this pier alone would make an interesting story. The boat transports the cement to four stor-

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GAYCO Air Separators operate with all types of mills, and accurately classifies all kinds of materials. The fineness is easily adjustable within a wide range of from 50 to 400-mesh, remaining constant regardless of any variation in speed or feed.

You are invited to check GAYCO advanced design and construction against any machine on the market for rugged construction, antifriction bearings, extra large separating chambers and efficient greasing system.

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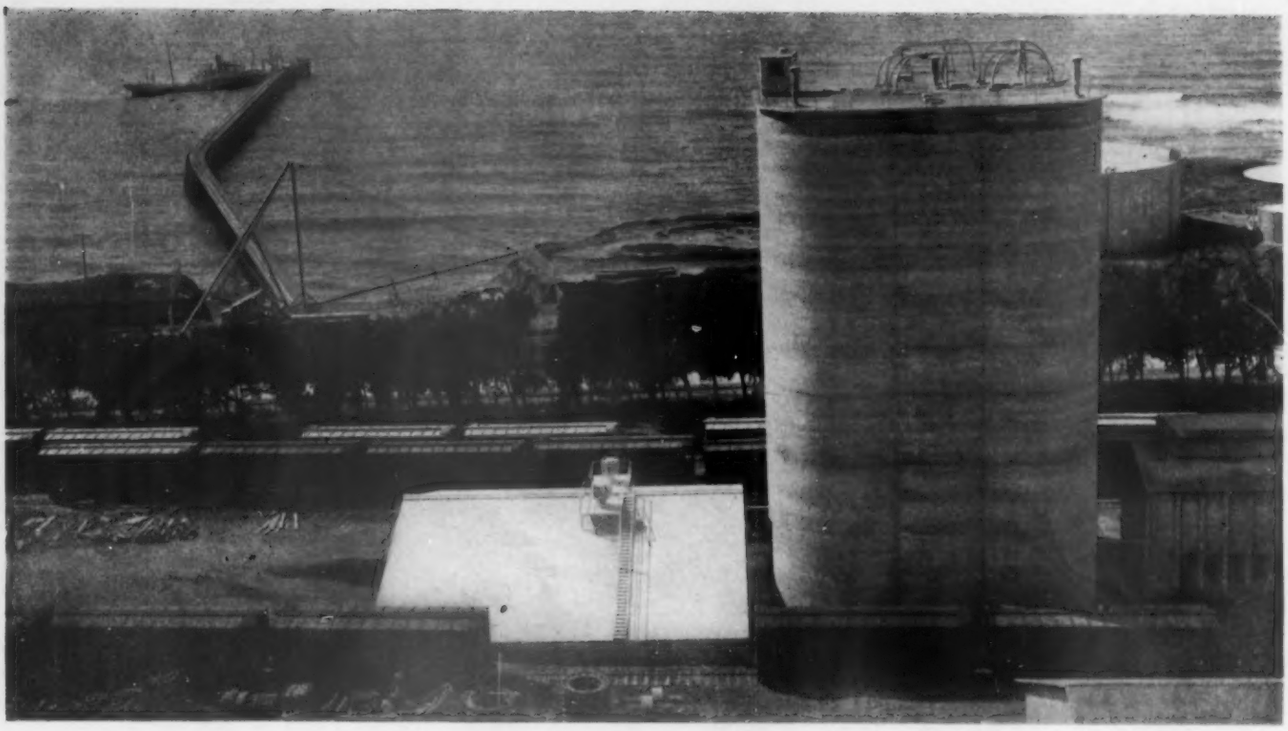


**The self-unloading boat "Santacruzcement" being loaded at the new dock at the Davenport, Cal., plant of the Santa Cruz Portland Cement Co. The new storage silos and compressor-house are in the foreground.**

age and distributing plants at Alameda, Stockton and Long Beach, Cal., and Portland Ore., the latter two being nearly 1,100 mi. apart by road and somewhat farther by water. The first boat-load of cement left the plant at Davenport in October, 1934. Although the company makes five types of cement only standard Portland and high-silica cements are ordinarily stocked at the distributing plants, except at Long Beach where oil-well cement is carried.

It is a tribute to the soundness of the conception and design of this distributing system and to the equipment involved that cement is being loaded, shipped and distributed at a cost considerably lower than was originally expected. The 45,000-bbl. cargo of the boat, for example, is being loaded at the plant in 22 hr. and unloading is done at about the same rate. The boat makes the trip to Alameda in 6 hr., to Stockton in 16 hr., to Long Beach in 28 hr. and to Portland in 60 hr. An average of five trips monthly is being made to the various stations and it is estimated that about 80 per cent of the cement produced at the plant is being shipped by boat. Shipments from the distributing plants are being made economically to points 200 mi. or more distant, the shipments being about equally divided between trucks and railroads. Also notable is the fact that this system can be extended at any time by building additional distributing plants at strategic points and that provisions have been made for the enlargement of existing storage and packing facilities.

The information presented in this article was obtained by the writer, who made a personal inspection of the cement plant, the boat and all the distributing plants. It is based also on similar previous visits. Except for the new distributing system only a few changes of minor importance have been made in the cement plant at Davenport since it was last described in PIT AND QUARRY. The same Fuller-Kinyon pumping equipment handling cement to the original car-loading and packing stock-houses handles cement to the new silos used for boat loading. There are four new concrete silos, each 32 ft. in inside diameter and 100 ft. high, and

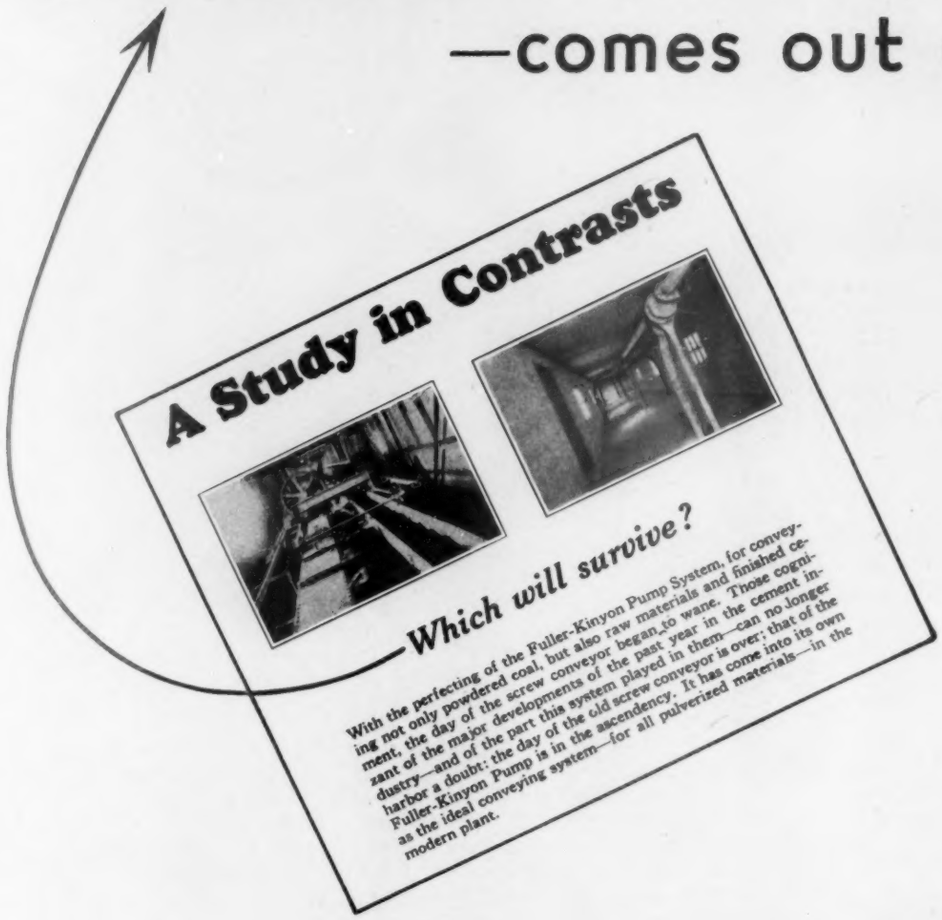
**Electrical control equipment for compressors and cement pumps at Davenport plant.**

**One of the two 12-in. pumps at plant which unload cement from silos to boat.**

**The 8-in. pump under Davenport silos used for plant shipments.**

# FULLER-KINYON

## —comes out on top


A Study in Contrasts
Which will survive?
With the perfecting of the Fuller-Kinyon Pump System, for conveying not only powdered coal, but also raw materials and finished cement, the day of the screw conveyor began to wane. Those cognizant of the major developments of the past year in the cement industry—and of the part this system played in them—can no longer harbor a doubt: the day of the old screw conveyor is over; that of the Fuller-Kinyon Pump is in the ascendency. It has come into its own as the ideal conveying system—for all pulverized materials—in the modern plant.

THE above is a copy of an advertisement which appeared eleven years ago. In those days there were many who were quite skeptical as to the safety and utility of such a machine. But, as the years progressed, these skeptics along with the old fashioned and outmoded methods of conveying fell by the wayside, until today, the Fuller-Kinyon System of conveying through pipe lines is the leader in its field for transporting dry pulverized materials.

This system has been adopted universally by the cement industry, and is used extensively in many other process industries for unloading, conveying, and elevating. During these years the Company has also developed and built the Fuller-Kinyon Unloader, adopted by contractors generally for unloading bulk cement from box cars.

The many advantages of the Fuller-Kinyon System have long since been conclusively proved. Minimum repair costs...only one moving part, the screw in the pump. Flexibility of application...pipe lines can be placed underground or overhead. Installations can be made where conditions would make any other system an impossibility.

Through many years of experience and close contact with the field and its requirements, the Fuller Company is today in a position to make studies of your requirements and furnish equipment that only the best engineering skill and careful workmanship can produce.

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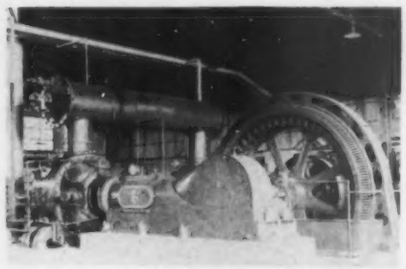
P-11

FULLER-KINYON, FLUXO, AND AIRVEYOR CONVEYING SYSTEMS . . ROTARY FEEDERS AND DISCHARGE GATES
ROTARY AIR COMPRESSORS AND VACUUM PUMPS . . AUTOMATIC BATCH WEIGHERS . . . BIN SIGNALS

these with their interstices and two included spaces have a total capacity of 90,000 bbl. Under the silos are the pump tunnels housing the equipment used for transferring the cement to the boat. Alongside these silos is the compressor room housing the two Ingersoll-Rand 4,500 and 4,700-cu. ft. per min. compressors which supply air at 40-lb. pressure for the boat-loading pumps. These compressors are driven by direct-connected General Electric motors of 800- and 930-hp., respectively, operating on 2,200-v., and 60-cycle current.

Under each of the two pairs of silos is a Fuller-Kinyon Type H 10-in. pump mounted with its motor on a movable carriage on rails. Five converging spouts under each silo feed to a junction box to which the pump is attached when it is desired to unload from that silo to the boat. An 8-in. movable pump serves the three included storage sections and pumps cement to the plant packhouse and bulk-loading facilities. The two 10-in. pumps are driven by 400-hp. Westinghouse synchronous motors with .8 power factor, operating at 900 r.p.m. and the 8-in. pump by a 150-hp. General Electric squirrel cage induction motor also operating at 900 r.p.m.

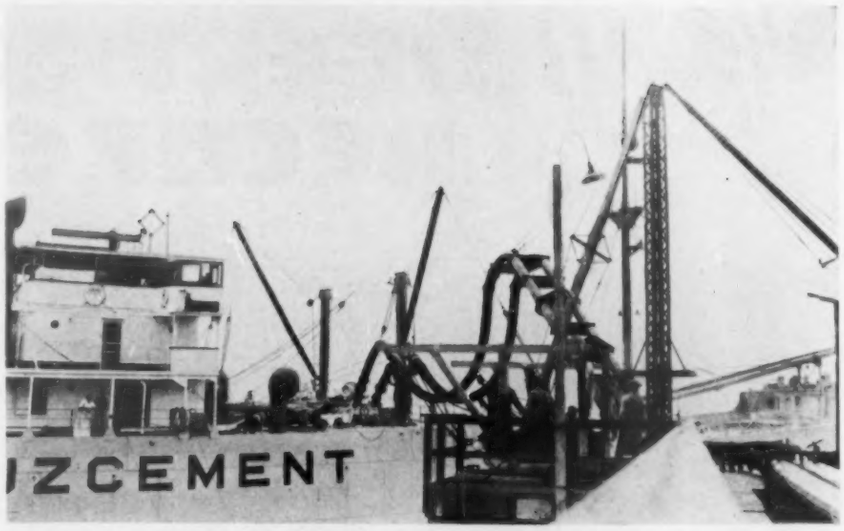
In July, 1935, a system for controlling the feeding of the cement to the two large pumps was installed. This was designed by A. T. Brownfield, an electrician in the employ of the cement company and, according to Joseph Riordan, superintendent, has helped in maintaining the rated capacity of 1,000 bbl. of cement per hr. per pump. Previous to the installation of this system the flow of cement from the silos to the pumps was irregular, with heavy slides occurring at intervals and overloading the pump motors. Following is a description of the control system in Mr. Brownfield's own words.



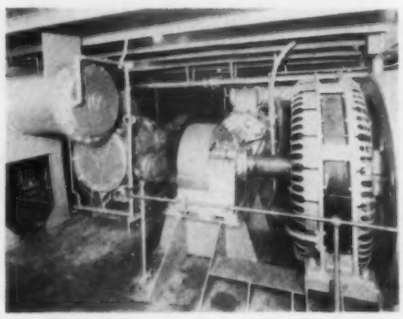
One of the two large compressors which supply air for the boat-loading pumps.

"To relieve the overload condition of the pump compressed air is forced into the pump hopper when the motor current increases above normal. Two magnetic air valves are used for this purpose. The opening and closing of each air valve is controlled by a solenoid connected in series with the motor driving the pump. The solenoid exerts a pull upon an iron plunger, the pull being proportional to the motor current. The plunger is fastened to one end of a balance beam. The other end of the balance beam carries a target which is free to move between a light source and a photoëlectric cell. When the motor current increases, due to slide, the pull on the plunger is increased, causing the target to pass between the light source and the photoëlectric cell, thus causing the sensitive relay of the photoëlectric-cell circuit to operate and close the circuit to the magnet of the air valve. The air valve upon opening allows compressed air to flow into the pump hopper, thereby relieving the overload on the screw. When the motor current returns to normal, the air valve again closes. Both air valves work in the same manner, one being adjusted to open at approximately 90 per cent. of the full load current of the motor, and the other adjusted to open at approximately 125 per cent."

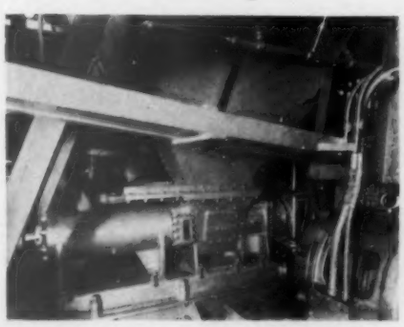
The two 12-in. pipe-lines carrying cement to the boat are about 3,500 ft. long and discharge at a level about 54 ft. below the pump level. Leaving the silos the pipes pass through a 6-ft. by 7-ft. tunnel which is cut in solid rock through the cliff and drops 54 ft. in its 360-ft. length. The 2,327-ft. pier begins at the point of emergence of the tunnel and, in addition to the two cement lines, carries a 3-in. water-line and a 6-in. oil-line to supply the cement carrier "Santacruzcement" with water and oil. There is also a narrow-gage railroad, used in building the pier, which is now used to transport sacked cement and supplies to the boat. A stiffleg derrick on the cliff lowers materials to the pier.




Derrick and rubber-hose system connecting permanent pipe systems on the boat and pier. This flexibility is necessary because of rough water conditions.



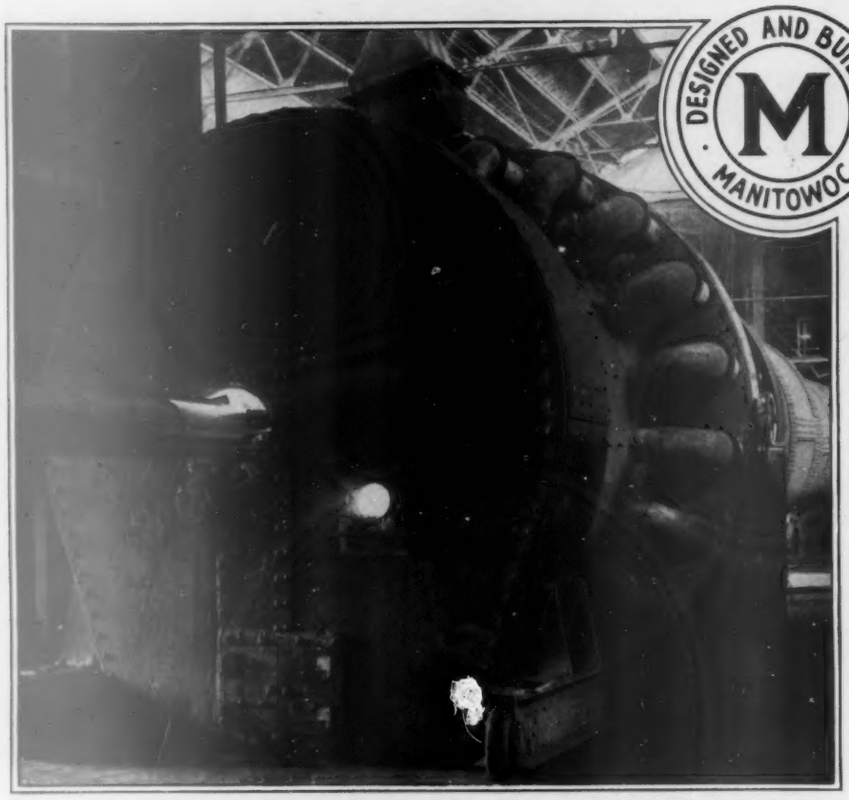
Two of the four compressors which supply air for cement pumps on the boat.



One of the two 10-in. pumps which unload cement from boat to shore silos.

Exhaustive surveys were made before construction of the pier was begun to determine the contour of the ocean bottom and its bearing qualities. A careful check was also made to be sure the pier would be headed directly into the heavy seas prevailing along this part of the coast. The first 840 ft. of the pier to the breaker line consists of 56 bents on 15-ft. centers, each bent having three 33-lb. H-column piles with cross, sway, and sash braces. The remainder of the pier beyond the breaker line is of heavier construction with 18-ft. bents.

# The VANDERWERP RECUPERATOR




10-Ft. Cement Kiln Installation of Type CI Short-Plate Recuperator

## *for* Rotary Kilns

THE VANDERWERP RECUPERATOR is the simplest and most efficient means of accomplishing the initial cooling of the clinker, with maximum heat recovery and full benefits in quality due to rapid air quenching.

The installation requires no alterations to existing structures, firing-hoods, or auxiliary equipment; excavations and foundations are unnecessary.

Space limitations in the kiln room in no case preclude the installation of Recuperators.

**Our new Type CI SHORT-PLATE RECUPERATOR, while departing in no way from the simplicity and soundness of design which characterizes our earlier units, embodies certain refinements in detail and provides even greater flexibility in operation.**

**It insures:**

- **Improved Quality of Cement**
- **Better Grindability of Clinker**
- **Maximum Fuel Economy**
- **Highest Efficiency of Heat Recovery**
- **Low Maintenance Cost**

**Kiln operators interested in obtaining the maximum benefits from air quenching and heat recovery—with proven equipment—are requested to write, without obligation, for full particulars.**

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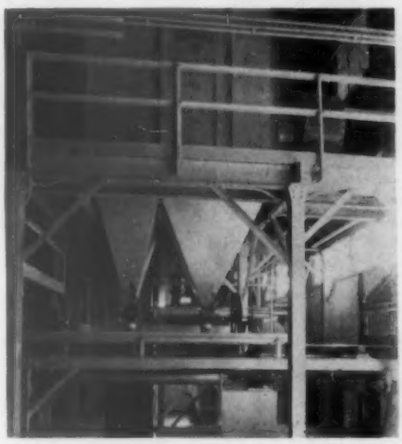
Scraper hoist on boat with tunnel discharge ramp at upper left.

Cylinder piles were first driven and 49-lb. H-column piles were driven inside these, the intervening space then being filled with concrete. In order to provide a structure that would withstand the constant battering of the waves all connections were made by arc-welding. The deck of the pier is 30-ft. above mean low-water level.

The 36-ft. square pier head at the sea end of the pier carries a derrick arrangement for supporting the lines to the boat. The ends of the two 12-in. cement pipe-lines are connected by 12-in. reinforced rubber hose to two pipe sections braced together and supported by the derrick from a hinged connection to the dock. Attached to the other ends of these suspended pipes are two long rubber-hose sections which are connected to the loading pipe systems which are permanently located on the deck of the boat. Because of the rough seas prevailing the boat is anchored about 50 ft. from the dock to insure against damage to either the boat or the dock. Even then no attempt is made to load the boat, if seas are unusually heavy. The boat is anchored to eight buoys connected to 16,000-lb. anchors, which are set in holes dynamited in the shale bottom for this purpose.

The boat *Santacruzcement,* which transports bulk cement from the plant at Davenport to the various distributing plants, is said to be one of the world's two largest self-unloading boats. Formerly known as the *Pacific Cedar,* this boat was purchased by the cement company and converted at a reported cost of $650,000. This work was done by the Sun Shipbuilding & Dry Dock Co. at its yards at Chester, Pa. The patented scraper system built by the Leathem D. Smith Dock Co. at Sturgeon Bay, Wis., is used.

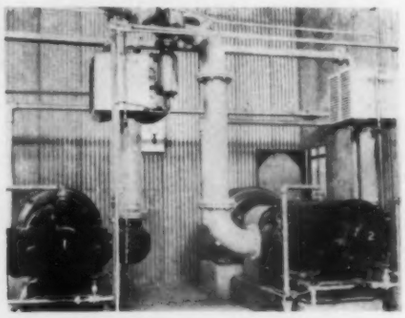
Practieally the entire interior of the vessel had to be rebuilt or altered, forming a watertight shell within the outer shell or hull. This inner shell has a bottom of saw-tooth cross-section formed by the two longitudinal scraper tunnels which reclaim the cement from the cement-storage hoppers. This inner shell is divided into cement hoppers with a total capacity of about 45,000 bbl. Each hopper can be unloaded separately so that several kinds of cement can be carried in one cargo. Amidships a section of the inner shell forms the boiler and engine rooms, and the room where the equipment for unloading cement from the forward end of the boat is located. Equipment for unloading cement from the after end of the boat is housed near the stern. The space between the bottom of the inner shell and the hull is used for water-ballast tanks and the space between the sides of the shells houses necessary wiring and



Typical dust-collector installation in packhouse at one of distributing plants.

piping. This arrangement is designed to keep the cargo of cement dry in case of collision even if considerable damage is done to the hull. Space is also provided for about 1,200 bbl. of sacked cement.

In addition to the equipment for handling cement the *Santacruzcement* is fitted with the latest in navigation instruments. Included is a fathometer for depth finding, a draft indicator which shows forward, stern and mean drafts, a radio compass, etc. Also amidships above the machinery hold are the pilot house and the quarters for the officers and crew. All the latest conveniences are provided and the quarters are as comfortable as any found on modern liners. Captain J. G. Tho,

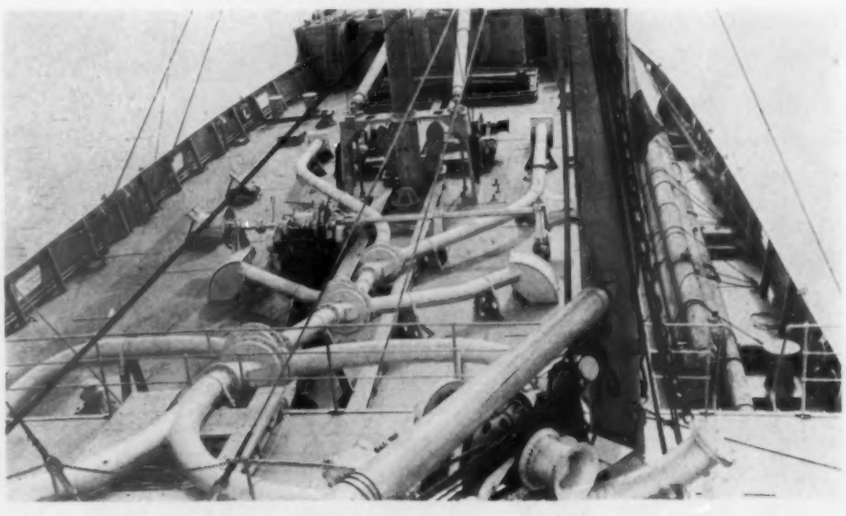


Two rotary compressors which operate cement pumps at Portland distributing plant.

master of the ship, has been sailing Pacific Coast waters for over 20 years.

The *Santacruzcement* has an over-all length of 414 ft., a beam of 54½ ft. and a draft when loaded of 24 ft. Three boilers produce steam at 200-lb. pressure for operation of the triple-expansion steam engine which drives the single screw. Turbine generators supply electric current at 2,300 V. for operation of all the other equipment by individual electric motors.

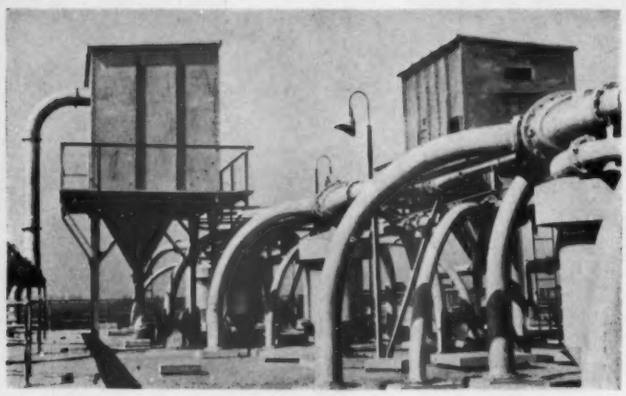
The design of the scraper system on the *Santacruzcement* is similar in principle to that of the *Cementkarrier* which is operated by the Canada Cement Co. and was described in PIT AND QUARRY when it was built several years ago. There are two forward and two aft scraper tunnels, each with a 4-cu. yd. Sauerman Crescent scraper. Cement



View of forward deck of boat showing boat-loading pipes. One of the pipe ends for connection to pier lines is in right foreground.

# SLY Dust Filters for Low Cost Dust Collection

## SLY INSTALLATIONS AT SANTA CRUZ PORTLAND CEMENT CO.



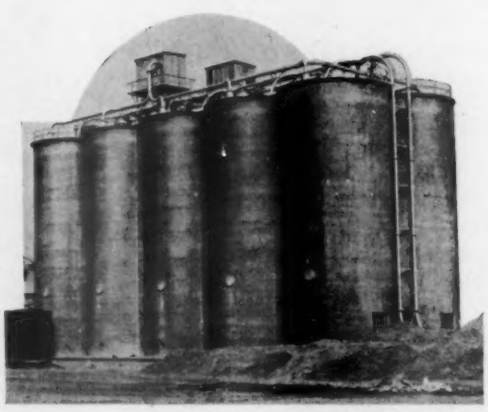
Close-up view of two Sly Dust Filters, shown below on roof of cement silos of Santa Cruz Portland Cement Company. Each filter has an integrally built fan house at the end—and filter and fan house mounted on Sly standard support with walkway, railing and ladder.

SLY DUST FILTERS OFFER THESE ADVANTAGES:—Simple design and standarized construction for low first cost, low erection cost, and low cost operation—Greater filter area per square foot of space—Exclusive cloth tube or bag suspension—Simplest kind of shaking device removes dust without injury to cloth—Quick changing of bags without interruption in service of filter—Easy access—and many other reasons for Sly popularity.

Many of the thousands of Sly Dust Filter installations are serving Rock Crushing Plants, Cement Plants, Gypsum Plants, Quarries, and Mines, etc.—and have convinced superintendents that it costs less to get rid of the dust nuisance than to tolerate it.

Let us show *you* how surprisingly simple and inexpensive the solution of your dust problems will be with Sly Dust Filters!

Write us your problems *now*. You'll find Sly recommendations effective and economical.



**SLY DUST FILTERS**

—for economical dust control, in—

- **ROCK CRUSHING**
  Trap Rock, Slate, Ore, Silica, Limestone.
- **GRINDING**
  Rock, Cement Clinker, Gypsum, Ore.
- **CONVEYORS**
- **ELEVATORS, ETC.**
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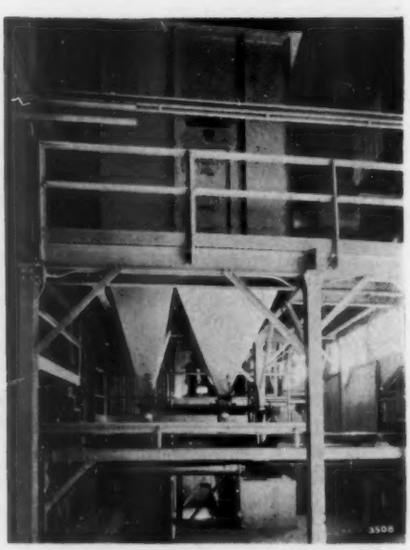
- **AIR PUMPING SYSTEMS**
- **PACKING OPERATIONS**
- **BAG CLEANING**
- **SILOS**

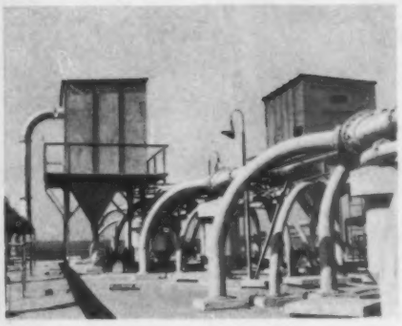
S. S. SANTACRUZCEMENT, world's largest bulk cement carrier, is equipped with four Sly Dust Filters.



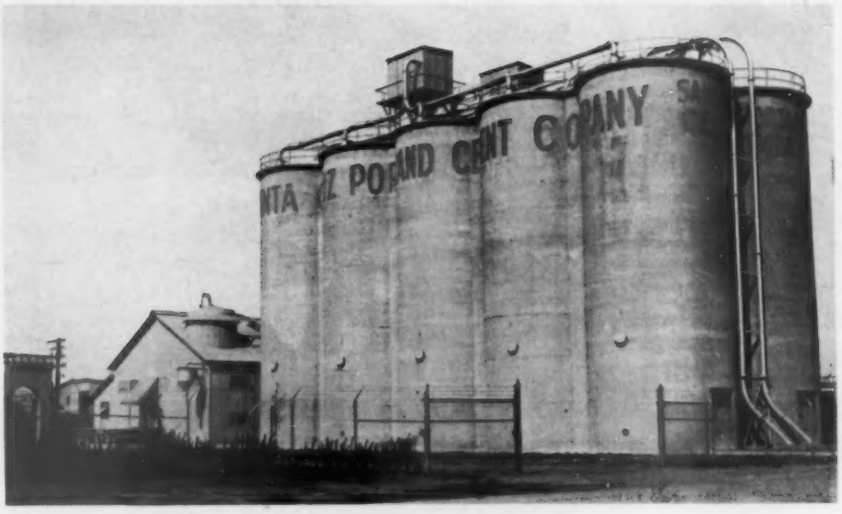
Sly Dust Filters in cement packhouse of Santa Cruz Portland Cement Company, Long Beach. Similar installations at their Stockton, Alameda, and Portland distributing stations.

**THE W. W. SLY MANUFACTURING CO.**

**4726 Train Avenue** *Established 1874* **Cleveland, Ohio**



The two dust collectors and cement pipes to silos at Stockton, Cal., plant.



Storage silos and packing plant at Stockton, Cal. Pipes at right carry cement from boat.

flows from the storage, whose sides slope at an angle of 45 deg. to prevent arching, through slide gates into the tunnels. The forward scrapers carry the cement back to ramps from which it is discharged to receiving hoppers on each side of the machinery compartment. The aft scrapers carry the cement back to similar ramps and hoppers in the stern of the boat. The cement is fed from these hoppers to the two Fuller-Kinyon Type H 10-in. pumps under the hoppers which transport it to the shore storage silos. The cement-discharge lines on the boat are also connected to the shore lines by rubber hose.

Each of the four drag scrapers is operated by a Sauerman double-drum hoist driven through silent chain by a 100-hp. Westinghouse motor. Each of the two cement pumps is driven by a 350-hp. Westinghouse motor. Compressed air for these pumps and for agitation of the cement in the hoppers is provided by four 23-in. by 13-in. by 16-in. Chicago Pneumatic two-stage air compressors which deliver 1,500 cu. ft. per min. each at a pressure of 50 lb. Each compressor is driven by a 300-hp. Westinghouse motor. Sly dust-collectors ars used. The scrapers are controlled from special rooms from which the operators can see the scrapers and the tunnels.

All four shore storage and distributing plants are of the same general design with a few minor differences because of local conditions. All are equipped with bagpacking and loading facilities and can ship bulk cement by truck, car or boat. All these plants were

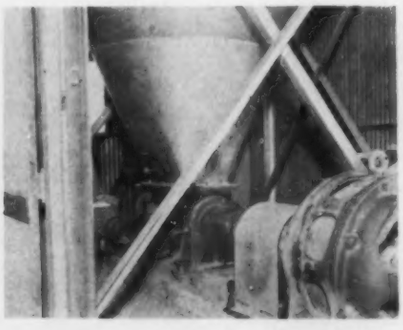
Storage silos and packing plant at Long Beach, Cal.

under construction at about the same time and were ready for use when the remainder of the system was completed.

The Portland plant, which was studied in most detail by the writer, is located at the foot of Lewis St. on the east bank of the Willamette River about 1 mi. from the heart of the city. The company's property has a 500-ft. river frontage with a timber dock extending almost the entire distance. The plant is about 300 ft. back from the dock and consists of twelve concrete storage silos each 24 ft. in diameter and 50 ft. high. Each silo has a capacity of 5,700 bbl. and each star bin holds 1,225 bbl., making the total storage capacity of 74,525 bbl. The usual Fuller-Kinyon system of valves and pipes is used to control the feed to the various silos. Two 2-section Sly dust-collectors on top of the silos are operated only when the silos are being loaded. Cement is pumped to the plant through two 10-in. pipe-lines.

Under each of the two rows of silos is a concrete tunnel in which is an 8-in. Fuller-Kinyon Type H pump mounted on rails. Under each silo five openings have spouts converging to a single connection and each star bin has two openings with a connection for each pump. The pumps can be moved into position by hand and connected to reclaim the

Storage silos and packing plant on river front at Portland, Ore. Trestle at right leads to boat-unloading dock.



The 8-in. pump at Portland plant used for loading bulk cement into cars or trucks.

# Continued Leadership

THE position of leadership in the field of cement mill equipment manufacture is maintained only by a constant development of more efficient machinery and methods to meet the ever rising standards of the cement industry.

Some Allis-Chalmers contributions to advanced plant and equipment design.

### GRINDING MILL PRACTICE

Leadership in advocating and building combination grinding mills known as Compeb Mills incorporating:

Grid division heads.

Combination division heads with outside peripheral screens for dry and wet grinding.

Return scoops for delivering material to the mill and grinding circuit at the most advantageous points intermediate to the feed and discharge ends of the mill.

Close circuiting of wet mills and more efficient grinding attained with moisture contents higher than contained in the kiln feed.

Progressive classified grinding system.

Concavex grinding media having high surface contact per unit of weight.

### KILN PRACTICE

Advocates of waste heat utilization to generate steam power with waste heat boilers.

Introduction of vacuum filters to reduce slurry moisture content.

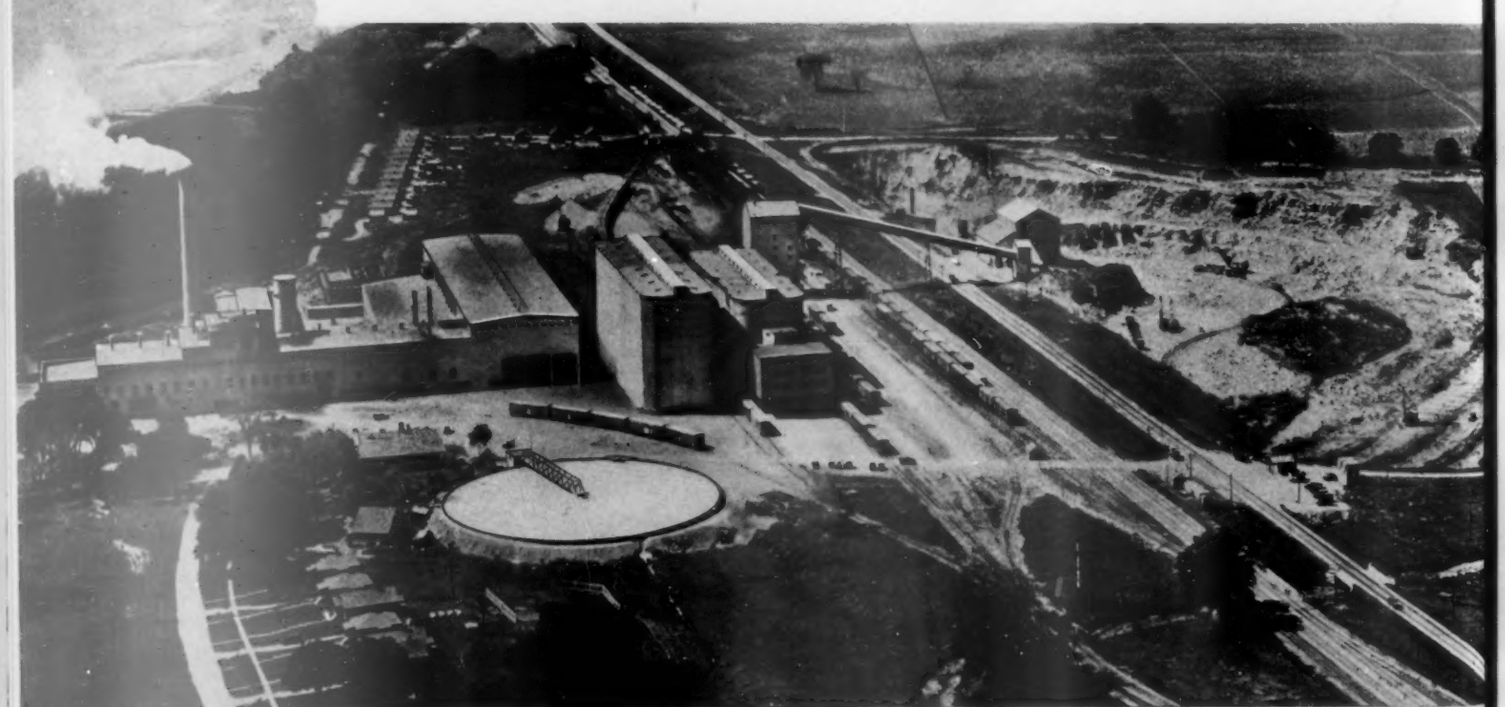
Enlargement of kiln diameter in the calcining zone for improved fuel economy and the production of a more completely and uniformly treated clinker.

The recent development now offered to the industry incorporates a chain type slurry dryer unit in combination kilns of moderate length, permitting the extended use of chain as a heat transfer medium to attain fuel economies commensurate with exit gas temperatures below 250° F.

Also as an alternate for existing kilns, introduction of a portion of slurry feed at hot end of slurry drying chains, in unit kiln of moderate length to attain fuel economies commensurate with exit gas temperatures below 250° F.

Research by our engineers 15 years ago pointed the way to the development of the Allis-Chalmers Air Quenching clinker cooler resulting in fuel savings up to 200,000 Btu. per barrel and greatly improved clinker grindability.

The inspection of Allis-Chalmers Cement Plant Equipment in process of manufacture and in operation can be arranged.



CRUSHING AND CEMENT DIVISION

ALLIS•CHALMERS

MILWAUKEE WISCONSIN

cement from any desired bin or silo. Each pump is driven by a 100-hp. General Electric squirrel-cage induction motor.

These pumps discharge the cement through a pipe-line direct to the packer bins or to a bulk-cement batcher bin. There are two Bates 3-spout valve-bag packers from which the bagged cement is discharged on a horizontal belt-conveyor, which is reversible and can discharge at one end for car loading and at either end for truck loading. Sacks are handled from the conveyor to the cars or trucks on the hand trucks.

The Fuller bulk-cement batcher is used for weighing out bulk cement for shipment either by car or truck. It has a capacity of 4,500 lb. and is of the automatic continuous-weighing type equipped with a Toledo Printweigh scale. The batcher is fed from the bin by two Fuller-Kinyon rotary feeders equipped with rotary valves. Another rotary valve discharges the cement from the batcher to an 8-in. Fuller-Kinyon pump which is driven by a 150-hp.

A 4-in. cement pump at Portland plant which returns packer spill to feed bins.

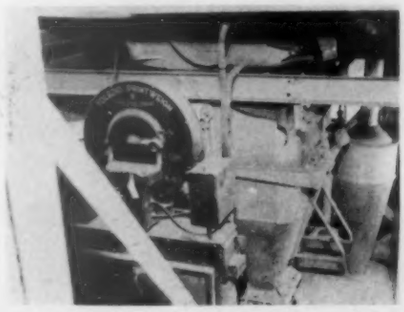
Westinghouse motor. At Alameda the pump serving the same function is also driven by a 150-hp. motor but the pumps at Stockton and Long Beach have 200-hp. motors. Ordinarily this pump discharges the cement through pipes direct to cars or to an expansion hopper for truck loading. When desired, this pump can also be used for blending the cement or for transferring it from one silo to another.

Cement spilled by the two packers is collected by two 9-in. Link-Belt screw-conveyors which discharge to a common hopper feeding a 4-in. Type H Fuller-Kinyon pump. This pump, which is driven by a 10-hp. motor, returns the cement to either of the two packer feed bins. The bag belt-conveyor and each of the two screw-conveyors is driven by a General Electric 3-hp. motor attached to a Pacific gear-motor. Another 2-compartment Sly dust-collector in the pack-house is connected to the batcher, the two packers and the cars being loaded with bulk cement. The cement collector is discharged to one of the spill screw-conveyors. Air for operation of the cement pumps and for other purposes is supplied at 50-lb. pressure by two Fuller rotary compressors each driven by a 200-hp. Westinghouse motor. Normal operations require the use of only one of these compressors, the second being used as a spare. Each of these compressors is driven by a 200-hp. Westinghouse motor. Storage space for empty sacks and for about 500 bbl. of sacked cement is also provided.

The storage-and-packing plant at Alameda, Cal. The boat "Santacruzcement" is partially visible at right. Part of skyline of Oakland in background.

The other three distributing plants at Stockton, Alameda and Long Beach, as previously stated, are almost identical with the Portland plant in design. The chief difference is that each of these three plants has only 10 silos with a total capacity of 61,900 bbl. Each of these plants has similar cement pumping, packing, batching and loading equipment and is equipped to ship bulk cement by truck, car or barge.

The Alameda plant is located near the Alemeda end of the Oakland-Alameda vehicular tunnel under the Oakland Estuary. This estuary is deep enough for steamers of the size of the *Santacruzcement,* which ties up at a timber dock about 300 ft. from the plant. The Stockton plant is at Port Stockton, about 1 mi. west of downtown Stockton and on the Stockton Channel which connects that city with San Francisco Bay and ocean traffic. This plant is located about 800 ft. from the dock.



Automatic continuous-weighing bulk-cement batcher at Portland plant.

The distributing plant at Long Beach adjoins the yards of Graham Bros., Inc., on the Cerritos Channel which connects with the Long Beach Harbor and the Los Angeles Harbor at San Pedro. At this plant cement is pumped 700 ft. from the dock. This plant is similar to the others except that the warehouse has a capacity of 1,500 bbl. of sacked cement. There is also an additional belt-conveyor to handle sacks from the packer belt to the warehouse. All cement handled at this plant is distributed by Graham Bros., Inc.

Much of the credit for the design of this new distributing system is due Robert A. Kinzie, consulting engineer for the company, who also made the detailed designs of the storage and handling systems at Davenport and at the distributing plants. Mr. Kinzie also designed the glory-hole system in use at the quarry and all the other improvements made by the company in recent years. The pier at Davenport was constructed by the Merritt-Chapman & Scott Corp. which also contributed to its design.

## May Reduce Curing Time of Concrete to 20 Min.

By what he calls a "vacuum-compression" method, Karl P. Billner, a Swedish engineer, claims to be able to reduce the curing period of concrete from 24 hr. to 20 min. He recently demonstrated his process at Yale University by pouring an 8-in. slab which, according to witnesses, was so dry at the expiration of the specified time that it could be jumped on without leaving an impression. The control slab took 24 hr. to set and nearly a week to dry. Concrete treated by the Billner process is also said to be free from cracks.

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THIS 2½-yard shovel is built to meet the requirements of high-speed output in rock and ore. The 85-B carries no excess weight; power is used for digging and not wasted on deadweight. In every part of the cycle, the 85-B has all the speed that the operator can use and, with the new, simple, positive, electrical control that responds instantly and accurately, the operator can use more speed than he has ever been able to use before. Investigate the modern performance and economy of the 85-B!

The massive strength and minimum weight of this 85-B counts for steady output in this New York quarry.

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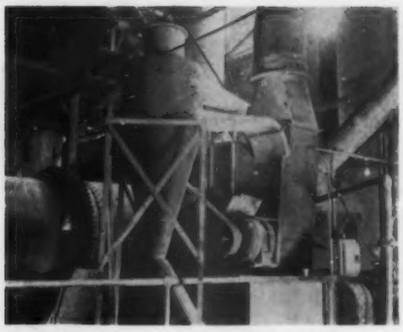
BUCYRUS ERIE

EXCAVATING, DRILLING, AND MATERIAL HANDLING EQUIPMENT...SOUTH MILWAUKEE, WISCONSIN, U.S.A.

# Interesting Results Obtained at Kosmos Cement Plant with New Dust-Precipitating Unit



Dust-precipitating unit connected to stone drier at Kosmos Portland Cement Co. plant.

THE Kosmos Portland Cement Co., Louisville, Ky., has conducted an interesting series of tests with a type of dust-precipitating unit which has been used successfully for years in other industries but is comparatively new to the cement industry. This unit, known as the Roto-Clone, is made by the American Air Filter Co., Inc., Louisville, Ky., and installations in several sand-and-gravel and silica plants have been described in past issues of PIT AND QUARRY.

The cement company was not confronted with any urgent need for dust-collection as it is located in a sparsely-settled community, but made these tests for its own information. Complete control of all the dust created in the operation of the plant is the ultimate objective with the purpose of providing cleaner and more healthful working conditions for the employees and improving the appearance of the plant.

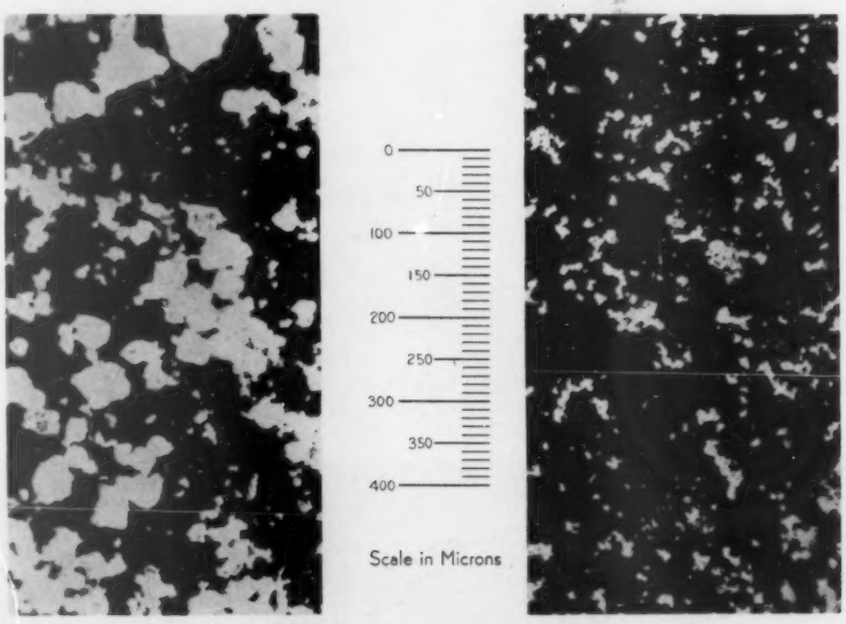
The first experiment was begun early in 1934, when the company installed a No. 12 Roto-Clone, rated at 3,500-cu. ft. per min. capacity, on a valve-bag packer. Later this unit was connected to a clinker cooler. In November, 1935, it was decided that a larger unit was needed and a No. 30 Type F Roto-Clone was purchased to replace the smaller unit. This unit was first installed in place of the existing fan on a waste-heat economizer and reclaimed 2 tons of dust daily from a single kiln. It was then moved to a stone drier to which it is now permanently connected.

The rotary limestone drier is a 6-ft. by 80-ft. unit with a capacity of 25 tons per hr. The Roto-Clone is connected to the discharge housing of the drier and exhausts through the stack which formerly supplied natural draft for the drier. This collector is also connected to two inclosed bucket-elevators, a screw-conveyor and a grinding mill in the same department, so it actually serves as a dust-collector for the entire raw-limestone department in addition to supplying draft for the drier.

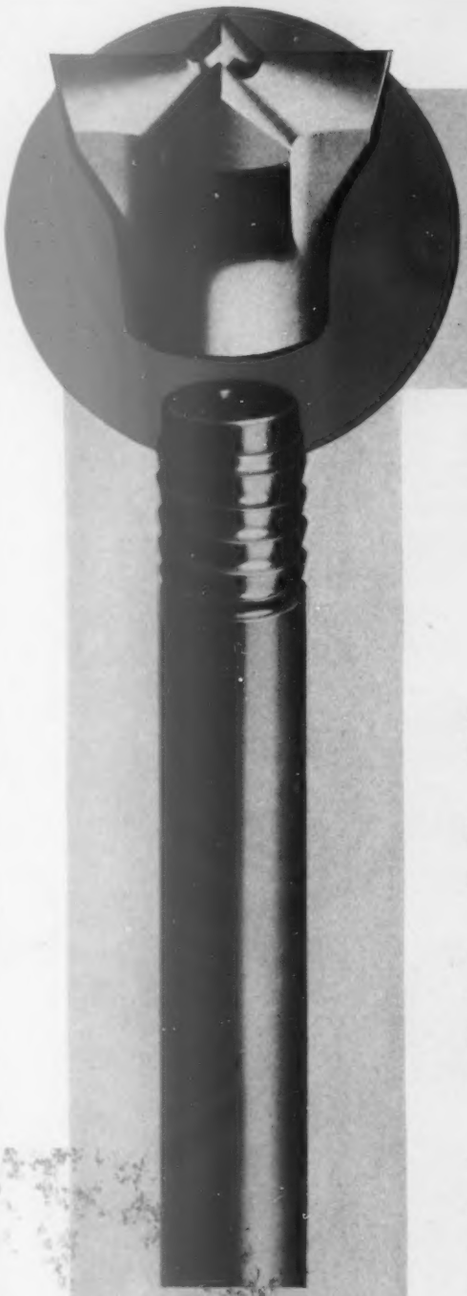
The Roto-Clone is operated at a speed of from 650 to 675 r.p.m. and handles about 15,000 cu. ft. per min. of air and gas of which about 6,000 cu. ft. per min. comes from the drier and has a temperature of about 350 deg. F. Although it is connected to a 30-hp. electric motor, only 15 hp. is actually required to operate this unit.

The Roto-Clone is precipitating an average of 12 tons of dust in 24 hr., about 70 per cent. of the total amount of dust entering the unit. All the dust is minus 325-mesh or 44-micron material. Practically 100 per cent. of the material coarser than 10 microns (2,-000-mesh) is precipitated as well as a fair proportion of dust down to one micron or less.

The action of the Roto-Clone has previously been described in detail in these pages so no more than a brief description is necessary. The complete Roto-Clone equipment known as the type F design consists of the Roto-Clone proper with cyclone type concentrator. The Roto-Clone is so designed that it not only creates a suction through its intake but also precipitates most of the dust in the air stream. In this installation the parts exposed to abrasion and wear, such as the impeller and dust scroll, are unlined as the limestone dust handled is not abrasive. The Roto-Clone discharge is so designed that approximately 95 per cent. of the air, with only the extremely fine dust, is exhausted through the drier stack. The other 5 per cent. of the air, with the concentrated dust, goes to the cyclone type concentrator, where the major portion of the dust is precipitated. The air exhausted from the concentrator is returned to the Roto-Clone intake in a closed circuit, thereby insuring complete removal of the dust from this circuit. A 4-in. Fuller-Kinyon pump has been installed to convey the dust collected by the precipitator to bins from which it is taken and blended with the raw material.




Photomicrographs of dust samples obtained from tests of the installation described here. At left are dust particles precipitated. At right, particles leaving precipitator discharge.



With Jackbits all energy is transmitted through the end of the drill rod. The patented I-R thread keeps the bit tight, yet makes the bit easily detachable. It is simple, sturdy, and has no deep or sharp undercuts.

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The Jackbit patented thread is simple, strong, long-lived and easy to make. Jackrods can be threaded with a hand threading tool; or in a power-operated threading machine; or in a lathe; or in an Ingersoll-Rand sharpener.

An experienced I-R rock drill man will gladly assist you in organizing an efficient method of handling Jackbits and Jackrods. A large I-R dealer organization is equipped to serve you and to help you with your regrinding, rethreading and reshanking if you do not use enough bits to warrant putting in your own equipment for such work.

If you are not already using Jackbits, we believe we can help reduce your costs and increase your output. Telephone our nearest office.

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336-5

# Cement Mills Spend Millions for Improvements as Shipments Soar to Highest Level in Five Years

RAPIDLY-RISING cement shipments recorded in the first half of this year have fully demonstrated the wisdom of those manufacturers who, in anticipation of just such a decided upward trend in sales, inaugurated large improvement programs designed to better the efficiency, lower the production cost, or widen the product-variety of their plants. Other manufacturers, a little more cautious and, perhaps, not so much in need of physical betterments in their facilities, have seen in the rising curve of cement shipments the spur to decision for which they had been waiting. As a result of both types of activity the physical plant of the cement industry is undergoing a remarkable renovation, a renovation made necessary in some cases by the growing demand for high-early-strength and other special cements, in others by the pressing need for lower production costs to meet the conditions existing in more efficient competitive mills, in still others by the rapid encroachments of obsolescence.

Prominent among the many improvements made in the last year or more are changes in the burning process, involving the substitution of direct-firing of the kilns for the older method of indirect-firing, the installation of devices for preheating, for initial and for final cooling of the clinker, and the provision in one case of a type of kiln new to this country. The grinding of raw material and clinker has undergone refinement and there have been numerous installations of improved grinding machinery designed to provide the better control required for meeting the modern demand for different types of cement. Dust-collecting equipment, of which there have been many installations within the period mentioned, has been receiving much more attention than in recent previous years. The increased interest in Diesel engines is shown by purchases of this type of prime mover for electricity generation. In one plant a raw-material blending and handling system has introduced a new form of control by the application of principles used abroad in the glass industry.

A recent survey of the entire cement industry discloses the great extent and variety of the improvements that have already been made and have been definitely decided upon. These range in importance from the installation of single machines of minor importance to complete rehabilitation plans involving the expenditure of millions of dollars by a single company. An effort will be made here to present a conspectus of these changes, selecting examples that will indicate their scope and variety. Needless to say the story is too long to be unfolded in complete detail, but information on improvements not mentioned herein will be found in recent and future issues of PIT AND QUARRY. Some of the improvements described in what follows will not be identified with specific plants or companies in deference to expressed wishes that their names be withheld.

Outstanding in importance among improvement programs that may be identified with their authors is that of the Universal Atlas Cement Co., which for some time has had awaiting release a huge plan for the betterment of its many plants. A program calling for the expenditure of more than eleven million dollars was recently put under way with the announcement that the company would spend $3,000,000 for the rehabilitation of its plants at Leeds, Ala., and Hudson, N. Y. New crushing and grinding equipment, new facilities for the storage of raw material, clinker and cement, and new shovels are among the scheduled improvements. The company's Northampton, Pa., plant is expected to be the next to undergo renovation. Already at its Independence, Kan., and Waco, Tex., plants improvements in the form of addition-cement-storage silos are being made.

Another large company, which prefers to have its name withheld, has completed extensive improvements in two plants and is considering other important changes. In one plant last year Babcock & Wilcox unit pulverizers for preparing coal for direct-firing were installed on all the kilns. In the words of the company's president, "these mills dry, pulverize and introduce the fuel into the kilns with absolute uniformity, thus maintaining perfect combustion. They completely eliminate dust loss, thereby saving hundreds of tons of fuel yearly, to say nothing of doing away with the hazard of coal dust and the unpleasant atmosphere which prevails in the vicinity of the ordinary coal drying and pulverizing plant. These mills reduced the coal-preparing cost more than half of what it was previously. About 18 lb. of coal per bbl. of cement manufactured is saved. This comes about by reason of eliminating the dust loss, using waste heat to dry the coal instead of drying it in a coal-fired drier and also because of the uniformity of the coal feed to the kilns, thus maintaining good combustion with no trace of CO."

Firite stokers were installed on the rock driers, using screenings instead of pulverized coal, and this installation has functioned "in a very satisfactory manner." Provision was made for the auxiliary firing of one of the waste-heat boilers in order to make steam available when all the kilns are out of service by the installation of the same type of stokers under the boiler.

At all loading points vibrating screens have been set up this year to remove *débris* from the cement which is loaded for shipment, and customers' complaints have been eliminated. In the quarry a large electrically-operated clay planer is being put in service to facilitate the removal of the hard clay overburden from the rock. This machine will work faster than a power shovel and at a greatly reduced cost per cubic yard of material. Cuttings from the planer will be conveyed to the spoil area through a pipe-line.

The company's facilities in the clinker-grinding department are being improved to provide a wider range in specific surface area and to maintain uniformity in the product. The changes involve the installation of equipment to deliver a uniform feed to the preliminary mills, thereby increasing the output of these mills and delivering to the finishing mills a product having a much greater percentage of minus 200-mesh material. The finishing mills will then operate in closed-circuit with air-separators of the latest type. A considerable reduction in the power consumption is expected to follow the completion of these changes. Dust-collectors are being installed.

At the other plant the company has completed and is making improvements fully as important. Last year the

(*Continued on page 65*)

WILLIAMS HAMMER MILLS FOR BETTER STONE CRUSHING

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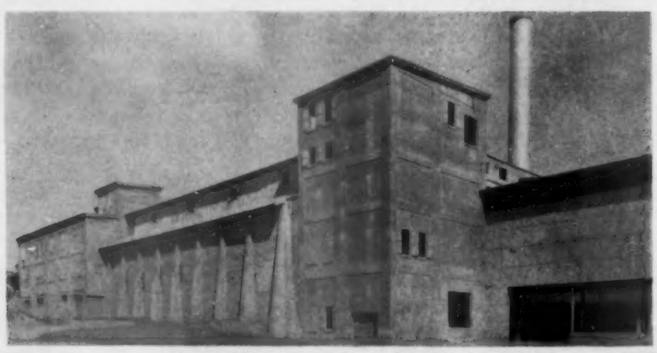

CHRISTIE DRYERS won distinction as first choice in several recent plant improvement programs.

Christie units are replacing previous units, saving floor space and increasing efficiency. They are drying sufficient raw material in one working day to provide for 24-hour operation of the plant.

They are of the indirect, reverse flow, rotary type, drying sticky clays or sandy materials with equal facility.

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**include latest mechanical improvements:—Anti-friction bearings throughout, totally enclosed driving gear with high speed shaft for direct connection to motor**

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power-plant was equipped with the latest type of superheaters, which provide a highly-superheated steam for the turbines and greatly increase the efficiency of these machines and safeguard them against damage from water slugs.

In the finish-grinding department the air-separators were modernized so that the finished product can now be classified to give any specific surface area from 1,400 to 3,000 sq. cm. per gr. The flexibility of the grinding department and the grinding capacity of the finishing mills have been increased and the making of a uniform product is assured. The bag department was completely revamped and equipped with air-conditioning apparatus.

This year the installation of Babcock & Wilcox coal pulverizers for the kilns was completed and a smaller unit was set up to take care of the rock and clay driers. Fuller-Kinyon equipment pumps the pulverized coal to the driers, the small mill being installed in the same battery with the large units.

A concrete stack, 350 ft. high, 29 ft. 8½ in. in outside diameter at the base and 18 ft. in inside diameter at the top, is being erected. The dust-laden gases will enter a large breeching between the stack and the kiln and drier stacks and will drop a large percentage of their dust there. Hoppers and screw-conveyors in the breeching will reclaim the dust, and greatly improve the atmospheric conditions in the vicinity of the plant. A Multiclone dust-collector has been installed.

The obsolete rotary screens in the commercial-stone plant were replaced by 4-ft. by 16-ft. Allis-Chalmers triple-deck vibrating screens, which make possible the production of stone meeting any specifications. The capacity is approximately 225 tons an hr. A large stone-scrubbing plant is also being installed.

At Okay, Ark., the Arkansas Portland Cement Co. installed a complete dust-collecting system in its mill building last year. The equipment was furnished by the Northern Blower Co.

The Ash Grove Lime & Cement Co. recently purchased 4 Babcock & Wilcox pulverizers for its Chanute, Kan., plant. A cooler is now being placed in service. The packing-house has been equipped with a complete Norblo dust-collecting system and similar equipment had previously been installed in the masonry-cement department.

A rather extensive improvement program was recently completed by the Bessemer Limestone & Cement Co., Youngstown, O. This included a new Norblo dust-collector, a Dixie hammer-mill, a Raymond bowl mill, and belt-conveyors and elevators. Previously two Vanderwerp recuperators had been installed and other betterments had been made.

The British Columbia Cement Co., Ltd., is spending about $50,000 for a somewhat unusual type of improvement. An aqueduct and four dams are being built for impounding water.

Fuller rotary compressors and Allis-Chalmers equipment for raw-material grinding have been installed by the California Portland Cement Co., Colton, Cal.

At its Belleville, Ont., plant the Canada Cement Co. recently completed the installation of a new F. L. Smidth kiln and cooler. Its Hull, Que., plant has been improved by the installation of a Babcock & Wilcox direct-firing unit coal pulverizer.

Betterments costing $220,000 were completed by the Cowell Portland Cement Co., Cowell, Cal., in May of this year. These included a Cottrell electric precipitator for dust control and a 235-ft. concrete kiln stack built by Rust.

Changes being made at the Cowan, Tenn., plant of the Cumberland Portland Cement Co. involve the installation of a Jeffrey vibrating feeder, a Dixie hammer-mill, and a pan-conveyor. Previously a Lee Process clinker cooler had been put in.

Two Oliver slurry filters were installed late last year by the Wabash Portland Cement Co. at Osborn, O.

At its Dewey, Okla., plant the Dewey Portland Cement Co. has arranged for a 20-ft. extension of the kiln and the installation of a Raymond bowl mill. For its Davenport, Ia., plant the company has bought 3 Babcock & Wilcox direct-firing unit coal pulverizers.

Improvements costing $100,000 have been completed by the Washington-Idaho Lime Products Co. in its cement plant at Orofino, Idaho. The finish-grinding capacity of the plant has been doubled.

Repairs and alterations in its cement plant at Merced, Cal., are being made by the Yosemite Portland Cement Co. The cost is approximately $60,000.

About a year ago the Federal Portland Cement Co. improved its facilities at Buffalo by the purchase of a Dixie Mogul hammer-mill.

The need for additional storage capacity led the Huron Portland Cement Co. to build 6 new concrete silos costing $40,000. These facilities, erected by the Burrell Engineering Co., provided cement-storage capacity of 50,000 bbl. The company's pack-house at Cleveland was equipped with a Norblo dust-collecting system.

Improvements costing $40,000 were recently made by the Idaho Portland Cement Co. at Inkom, Idaho. Silos for storing 50,000 bbl. of cement, a Traylor-Cheesman burner, a Schaffer Poidometer and 5 Minogue slurry agitators were purchased and have been installed.

An appropriation of $2,430,000 has been made by the International Cement Corp., New York, for the building of new plants at Parana, Argentina. About half of this sum will be expended this year. The building of a mineral-flotation plant is part of the program. For improvements in its plants in the United States $535,000 has been allotted.

The washing equipment in the quarry of the Kosmos Portland Cement Co., Louisville, Ky., is being improved by the installation of the second 4-ft. by 14-ft. Allis-Chalmers double-deck vibrating screen. Improvements being made at the Kosmosdale plant include the erection of a 315-ft. kiln stack built by Boland and the installation of a dust-collecting system for the waste-heat boilers and the raw-material grinding department.

Four 20-in. Schaffer Poidometers were installed last year in the Iola, Kan., plant of the Lehigh Portland Cement Co. for proportioning the clinker and gypsum fed to the Hercules mills. For the company's Fordwick, Va., plant Weber built a 275-ft. kiln stack and 12 new concrete blending bins were erected. A Sly dust-arrestor, three 14-ft. Sturtevant air-separators, a clinker crusher, a Bethlehem drag-conveyor, and two 1,200-hp. Babcock & Wilcox Sterling waste-heat boilers with economizers, superheaters and 10-ft. Sturtevant fans were installed.

The Lone Star Cement Co., Alabama, recently made several improvements in its Birmingham plant, including the installation of a new Babcock & Wilcox pulverizer.

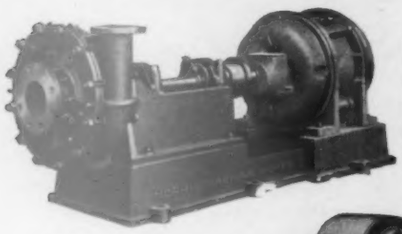
The Lone Star Cement Co., New York, Inc., is installing two 16-ft. air-separators made by Bradley in its cement-grinding department at Hudson.

At Nazareth, Pa., the Lone Star Cement Co., Pennsylvania, spent approximately $50,000 late last year for the construction of a new crusher building and new rock-storage facilities and for the installation of a new overhead crane in the rock-storage building. Early this year the company bought 3 Babcock & Wilcox pulverizers and a Traylor kiln. Extensions and improvements to cost about $75,000 will be undertaken this summer.

In January of this year the Louisville Cement Co., Speed, Ind., contracted for a $50,000 addition to its plant. The new equipment installed included a Raymond air-separator. An order has just been placed for a complete Norblo dust-collecting system in the raw-material and finished-product grinding departments. Late last year a new shovel and a tractor were added in the quarry.

*(Continued on page 67)*

# When new pumping equipment is to be purchased....

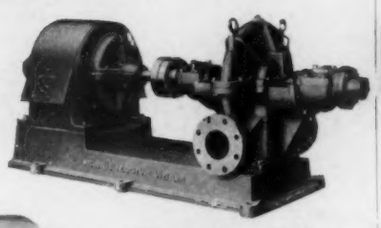


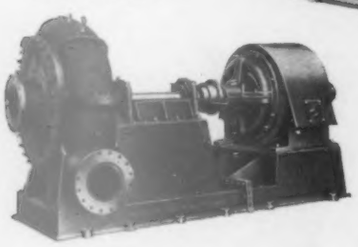
SLURRY PUMP

Shell, impellers, stuffing box, shaft, bearings and frame all specially designed for maximum efficiency, rigidity, and wear. These pumps will operate with complete satisfaction on high suction lift, or with high temperature liquids, acid slurries, and other difficult conditions.

GENERAL SERVICE PUMP

The wide range of impellers available for these pumps permits operation at suitable speed with maximum efficiency.





LINED DREDGING PUMP

for handling heavy or sharply abrasive sand and gravel. Special alloy linings save in replacement expense. Other types of Dredging Pumps available for light and medium duties. Also complete hydraulic dredges.

YOU want to know not only the cost but the complete background of the pumps you buy —their design, workmanship, previous performance and company responsibility.

The results of your investigation of Morris Pumps for cement slurry, dredging, or sand and gravel plant service are sure to prove highly satisfactory. Morris, the originator and first American manufacturer of centrifugal pumps, has an unmatched experience of 72 years covering every type of pumping service and specializing throughout that time on building pumps for handling abrasive materials. The present-day design of Morris Pumps reflects this experience through many special features that have proved to promote exceptionally high efficiency and durability. Morris Pump performance has won the hearty commendation of plant engineers all over the country because of the thoroughly dependable and trouble-free operation which uniformly characterizes each Morris installation. Finally, the unwavering policy of standing squarely back of each Morris Pump, which has been faithfully followed throughout the long history of the Morris organization, assures fair dealing in every respect.

You will be safe in specifying Morris Pumps for every abrasive-handling and general service. **Send the coupon today for catalogues describing Morris pump designs for services in which you are interested.**

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**CENTRIFUGAL PUMPS**

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Please send copy of catalogue describing Morris Pumps for the following service:.....
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P & Q 6-36

**FAST**

Only in a Gardner-Denver Drill Steel Sharpener will you find a ram that is raised *instantaneously* upon release of the downstroke air.

**POWERFUL**

Only in a Gardner-Denver Sharpener do you get double die pistons in tandem—providing greater clamping pressure than is possible with sharpeners having single die piston construction.

**ECONOMICAL**

Although the Gardner-Denver DS-2 Sharpener has two pistons for clamping when power is needed, air is admitted to only one piston for the relatively light fullering and swaging operation.

*Gardner-Denver DS-2 Drill Steel Sharpener*

**GARDNER-DENVER COMPANY**
**102 Williamson Street** **Quincy, Illinois**

**SINCE 1859**

**GARDNER-DENVER**

## Lehigh

(from page 47)

Clinker is discharged from the kilns to a pit, where it is partly cooled by water sprays. It is then reclaimed by bucket-elevators which discharge it to 10 special Lehigh vertical coolers, where the clinker is cooled as it falls by an updraft of air. Belt-conveyors equipped with Goodyear heat-resisting belting discharge the cooled clinker into a clinker storage 100 ft. square. Tunnel belt-conveyors reclaim the clinker to hopper scales which proportion the clinker and gypsum.

The mixture is discharged on a belt-conveyor which in turn discharges it on a grizzly for the removal of fines. The coarse material goes to a Sturtevant rotary crusher, whose product, together with the grizzly fines, is distributed to 10 steel mill-feed bins of 175-bbl. capacity each by a 58-ft. drag-conveyor. These bins feed 10 Bradley Griffin mills which are reconditioned units brought from the company's plant at Mason

The three new 14-ft. separators operating in closed circuit with finish-grinding mills.

City, Ia., and are driven by individual 100-hp. vertical motors through Goodyear drive belts.

The Griffin mill product is carried by a screw-conveyor and an elevator to another screw-conveyor from which screw-feeders discharge it direct to three F. L. Smidth 18E tube-mills. Any material in excess of the requirements of these mills passes these feeders and is discharged from the screw-conveyor into a surge bin feeding a Smidth 16B tube-mill. The product of all four finish-grinding mills is carried by screw-conveyors to three 14-ft. Sturtevant separators whose rejects are fed by screw-conveyors to the elevator in the tube-mill feed circuit. The product of the separators, 96 to 97 per cent. through 200-mesh when standard Portland cement is being produced, is fed by a series of elevators and screw-conveyors to the cement-storage silos. A Sly dust-arresting system is connected to the finish-mill equipment and keeps this department practically dustless.

The ten concrete cement storage silos have a total capacity of 17,000 bbl.

View in boiler room showing fans and economizers with boilers in background.

Screw-conveyors reclaim the cement from storage and a series of screw-conveyors and elevators feed it to four Bates 3-spout packers. Belt-conveyors carry the sacked cement to cars and weights are checked on Toledo scales. A screw-conveyor over the packer bins allows the direct loading of bulk cement into cars. One of the old stock-houses is in use as a bag house and another has been remodeled for the storage and packing of high-early-strength cement.

All the improvements described were designed by the engineering staff of the Lehigh Portland Cement Co. and carried out under its supervision.

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## Cement Improvements

(from page 65)

The Wampum, Pa., plant of the Medusa Portland Cement Co. recently purchased two Vanderwerp recuperators. A new rotary cooler, following one of the Vanderwerp units, was installed later and handles 4,000 bbl. of clinker daily. The raw-material grinding department has been equipped with two 16-ft. Sturtevant air-separators.

The Missouri Portland Cement Co. made extensive improvements to its plants last year. These included the installation of a new system for blending and handling raw materials to provide better control. An order for a Norblo dust-collecting system for the clinker-handling department has just been placed.

In its Monolith, Cal., plant the Monolith Portland Cement Co. installed new F. L. Smidth Kominuters and Tyler Hum-mer screens last year. A crane was added to the storage-department.

New concrete silos were erected for the North American Cement Corp. at Alsen, N. Y. The construction work was done by the Nicholson Co.

A Sly dust filter of the flat-bag type was installed by the Olympic Portland Cement Co. at Bellingham, Wash. This recovers the dust from four 4-tube Bates bag-packers in the stock-house.

In 1935 the Peerless Cement Corp., Detroit, Mich., installed a 3,750-kv.-a. General Electric turbo-generator, which was followed by a second unit of the same size this year. Three Babcock & Wilcox unit pulverizers for direct-firing of the kilns were placed in operation this year, two on April 1 and the third on June 18. A small Babcock & Wilcox direct-firing mill was installed on the auxiliary boiler.

The Pennsylvania-Dixie Cement Co. has bought two Babcock & Wilcox mills for its Des Moines, Ia., plant. Other improvements have been made. At its Richard City, Tenn., plant two new Sturtevant air-separators have been installed.

One hundred thousand dollars' worth of improvements have been made this year at the Petoskey, Mich., plant of the Petoskey Portland Cement Co. A system of Norblo dust-collectors is part of the betterment program.

A two-year improvement program of considerable scope has just been completed by the San Antonio Portland Cement Co., San Antonio, Tex. The changes made this year include the installation of an 8-ft. by 50-ft. Traylor 4-compartment mill of new design, a large Norblo dust-collector, a 2,000-hp. Rathbun-Jones Diesel engine, and a 1,250-hp. General Electric motor. Last year's improvements included Lee Process clinker coolers, a Raymond air-separator, and other dust-collectors.

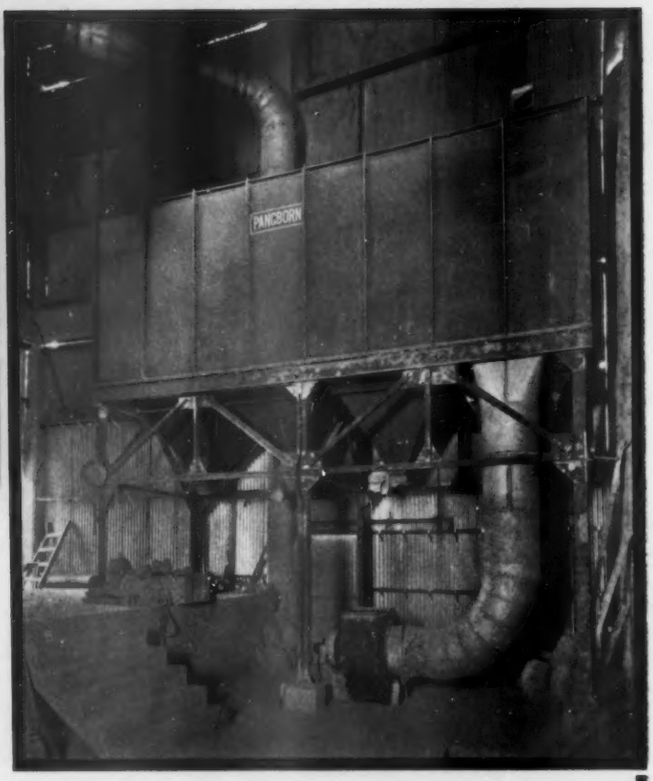
Improvements costing approximately $50,000 have been completed at the plant of the Signal Mountain Portland Cement Co. at Signal Mountain, near Chattanooga, Tenn. Two new Babcock & Wilcox pulverizers were added in May.

A fleet of 10 Sterling motor trucks, powered with Cummins Diesel engines, was placed in operation last year by the Southwestern Portland Cement Co., Victorville, Cal. Each truck draws a semi-trailer capable of hauling 100 bbl. of sacked cement.

A quarter of a million dollars is the cost of extensive improvements made last year by the Spokane Portland Cement Co. of Spokane, Wash. More than five car-loads of machinery, including a Lepol kiln (the first of its kind in America), were furnished by the Polysius Corp. The program included the construction of new concrete raw-material blending and cement-storage silos and the installation of a new Babcock & Wilcox finish-grinding mill, a Schaffer Poidometer, a Sturtevant air-separator, Redler conveyors, and Cera (Polysius) raw-material and cement pumps.

New Babcock & Wilcox direct-firing coal pulverizers were installed in April of this year by the Three Forks Portland Cement Co., Trident, Mont.

# *controlling cement* DUST




Cement Dust is eliminated from crushing and screening processes with this Pangborn Collector at the North American Cement Corporation Security, Maryland.

*Grinding and processing operations on cement, stone, gypsum, coal, lime and other quarry products liberates dangerous and destructive Dusts.*

..CONTROL this expensive and unnecessary waste as 3476 others are controlling it .... by installing a PANGBORN Steel Frame, Cloth Screen, DUST COLLECTOR.

Backed by more than a quarter century of successful dust collecting experience the PANGBORN DUST COLLECTOR is the last word in simplicity (all moving parts in clear air side), efficiency (requires minimum attention), and low cost operation (adaptable in size to fit every space requirement).

Write for free "Industrial Dust Control Through Exhaust Systems" book.

# PANGBORN

**WORLD'S LARGEST MANUFACTURERS OF BLAST CLEANING AND DUST COLLECTING EQUIPMENT**

**PANGBORN CORPORATION . . HAGERSTOWN, MD.**

## St. Paul Meeting *(from page 28)*

*Government Contracts Bill.*—Subcontracting functions appear to be exempted from the bill, with the exception of that provision dealing with prohibiting the performance of any government contract under working conditions which prejudice the health or safety of employees. A further provision which seems to exempt our industry from the operations of the bill is Sec. 11 which states that it shall not apply to purchases of materials which may usually be bought in the open market. Exactly what this means will not be ascertained until the bill is officially interpreted by the Secretary of Labor, although it may be expected that an effort will be made to give the bill a construction which will extend its application to the maximum number of industries.

Particularly objectionable to our industry would be that provision of the bill which arbitrarily establishes the 8-hr. day and the 40-hr. week. Such a provision was never seriously proposed for incorporation in the code which applied to our industries. I believe that we might be prepared to commend that part of the measure which prohibits bid peddling and bid shopping, but I believe I correctly interpret the sentiment of our industry when I say that as a general proposition it is opposed to concentration within the Federal government of the power to control the wages and hours of employment in any industry.

*The Relief Bill.*—The $1,425,000,000 authorized for the Emergency Relief program for the fiscal year ending June 30, 1937, will be used in the discretion and under the direction of the President. It is allocated as follows: for highways, roads and streets, $413,250,000; for public buildings, $156,750,000; for parks, facilities and buildings, $156,750,000; for public utilities, water and sewer systems, $171,000,000; flood control, $128,250,000; assistance for educational, professional and clerical persons, $85,500,000; for women's projects, $85,500,000; miscellaneous work projects, $71,250,000; National Youth Administration, $71,250,000; and for loans to and relief of farmers and live stock growers, $85,500,000. To the $1,425,000,000 would be added the combined unexpended balances of earlier WPA appropriations under the Emergency Act of 1935, these funds to remain available until June 30, 1937. . . .

So far as the Works Progress Administration is concerned it seems likely that there will be no important change in the program of this organization. To some extent, particularly in metropolitan communities, WPA purchases have their effect in our industry, but we and allied industries, by formal resolution and otherwise, have expressed our opposition to the use of WPA funds to financing governmental sand-and-gravel plants. While we found no disposition within the WPA to ignore our objections, we have been told that our relief lies in an appeal to state and county agencies using WPA funds. I recommend that this avenue of approach be used to the fullest extent possible. . . .

*The Price-Control Bill.*—It is a complicated measure adopted by the Congress without a roll-call vote in either branch, designed to yield to the popular clamor for placing independent business on a parity with chain stores in the purchase of commodities from large manufacturers. The bill as enacted and signed by the president goes far beyond any such objective. It is said that the Federal Trade Commission, characteristically enough, will move slowly in putting the bill into effect, but in the meantime we are impressed by an analysis of the bill issued by the U. S. Chamber of Commerce, the substance of which appears below.

"Sec. 2 of the Clayton Act is rewritten. In its new form it is made unlawful for any person engaged in commerce, in the course of such commerce, to discriminate in price between different purchasers of commodities of like grade and quality, where any of the purchases involved are in commerce, and are sold for use, consumption, or resale in the United States, the territories, insular possessions, or other places under the jurisdiction of the United States, where the effect of such discrimination may be, (a) substantially written to lessen competition or tend to create a monopoly or, (b) to injure, destroy, or prevent competition with any person who either grants or knowingly induces or receives the benefits of such discrimination, or with their customers.

"To the above acts declared unlawful the following limitations are provided:

"(1) The Act would not operate to prevent differentials making only due allowance for differences in cost of manufacture, sale, or delivery resulting from differing methods or quantities in which commodities are sold or delivered to purchasers. The Federal Trade Commission is authorized, after investigation and hearing, by order to fix quantity limits (revising the same from time to time as might be necessary) with respect to particular commodities or classes of commodities.

"(2) Another limitation permits price changes with respect to goods readily perishable, those suffering obsolescence through seasonable changes, distress sales under court process or sales to discontinue business in the goods concerned.

"(3) The measure also reserves to persons engaged in selling goods the right to select their own customers in good faith and not in restraint of trade. In hearings involving complaints as to discrimination the burden of proof in rebutting a showing of discrimination would be upon the person charged with violation. Unless justification is affirmatively shown the commission could issue its order terminating the discrimination. A seller, however, might rebut a *prima-facie* case of discrimination by showing that the price complained of was made in good faith to meet an equally low price of a competitor.

"The bill also prohibits the payment or acceptance of commissions or discounts speciously made in connection with sales in commerce, as well as allowances made for services or facilities furnished which are discriminatory as between purchasers.

"Penalties of fine ($5,000) or imprisonment (one year) or both are provided for such acts as (1) being a party to or assisting in sales which discriminate against competitors of the purchaser by means of discounts, rebates, allowances, or advertising services which are not available to competitors of the purchaser at the time of sale of goods of like grade, quantity, and quality; (2) selling goods in any part of the United States at prices lower than those exacted elsewhere for the purpose of destroying competition or eliminating a competitor, or selling at unreasonably low prices for the same reason.

"The act would not be construed to prevent a coöperative association from returning net earnings to its members in proportion to their dealings with or through the association."

*Basing-Point Prices.*—Two bills which were introduced in Congress but failed to pass, would have greatly enlarged the powers of the Federal Trade Commission (1) by giving it the right to deal with any act or practice the commission considered unfair to the public, even though there is no competition; (2) effectively to prevent further use of the basing-point or delivered-price system of sales. The Federal government, particularly through Mr. Ickes, has been insisting that identical prices are conclusive evidences of illegal conspiracy. The president has ordered the Department of Justice to make an investigation of identical steel prices submitted on a particular project, and it is well to anticipate that in the next Congress, regardless of party domination, an effort will be made to render illegal any of the delivered-price or basing-point systems. The materials of our industry are frequently sold on a delivered-price basis, and for that reason legislation of this character should command our attention.

STANTON WALKER, the association's director of engineering and research, discussed briefly some of the problems confronting the sand-and-gravel industry. Among other things he said:

*Concrete Road Construction.*—Most sand-and-gravel producers are familiar with the fact that, until a few years ago, several states barred the use of gravel in concrete roads on primary systems, because it was believed that the rounded particles of gravel resulted in lower strengths and in more frequent cracks than the angular fragments of crushed stone. That handicap, based on lack of information and on misinformation, has been overcome except in a very few localities. However, some specifications still penalize the use of gravel by requiring some proportion of crushed particles, additional expansion joints and planes of weakness, or richer proportions.

Let it be clearly understood that any penalties on the use of gravel in concrete road construction which are based on shape of

*(Continued on page 74)*

## O A S I S

THOSE who attended the St. Paul meeting must forever remember the enjoyable outing arranged for them by J. L. Shiely and Mrs. Shiely at their beautiful country place at Prescott, Wis. Located high on the bluffs of the St. Croix River just north of its confluence with the Mississippi the guests escaped for awhile the city's searing 106-degree heat. Some went in for motor-boating or swimming, others elected to try their aim at trapshooting. But all went in for, and pronounced excellent, the appetizing hot-weather supper served buffet-style in the cool depths of the Shiely's basement dining room. Another of the day's high spots was a 20-mile ride up the St. Croix and down the Mississippi. In the evening Henry T. Corr, one of the group, entertained with some cleverly-executed card and coin tricks on the lighted tennis court.

# Technical Advance Reviewed at A.S.T.M. Annual Meeting

WITH a record-breaking attendance, a great many actions on proposed new standards and adoption of existing tentative specifications as standard, a number of outstanding sessions and intense activity on the part of Society committees, the thirty-ninth A.S.T.M. annual meeting held in Atlantic City, June 29-July 3, was an outstanding one. The registered attendance was 1,131. This compares with the previous high in Atlantic City in 1930 of 1,092 and exceeds that of any other meeting save the one held in Chicago in 1931.

It was announced that the 1937 annual meeting would be held in New York, N. Y., at The Waldorf-Astoria, June 28-July 2.

At the 1936 meeting, 18 formal sessions were held and over 100 technical papers and reports were presented. Six technical papers and two committee reports dealing with cement, lime and aggregates were presented. Recommendations made in the report of Committee C-1 on Cement were approved, including revisions of the Tentative Specifications for High-Early-Strength Portland Cement (C 74-30 T) involving a new definition, insertion of optional compressive-strength requirements and a fineness requirement prescribing a specific surface of not less than 1900 sq. cm. per gram of cement. The revised specification is to be submitted to Society letter ballot for adoption as standard.

A proposed specification for high-early-strength treated Portland cement which was preprinted in the report was withdrawn by Committee C-1. The only difference between this and C 74 was in the definition which permitted certain additions not allowed by the definition in C 74. This feature is to be incorporated in C 74 instead of having a separate specification.

S. B. Biddle, Jr., and Alexander Klein, University of California, described *A Hydrometer Method for Determining the Fineness of Portland-Puzzuolan Cements.* To supplement the common methods of mechanical analysis of Portland cement and to assist in extending the use of such methods into the field of Portland-puzzuolan cement, a hydrometer method of analysis has been adapted from that commonly used in soil analysis. The paper states that if a sample of cement is uniformly dispersed in a suitable liquid medium and simultaneous observations of elapsed time and of specific gravity (as measured by a hydrometer) are made as the particles settle, the particle-size distribution and surface area of the sample may be calculated. It has been demonstrated according to the authors that for Portland cements the surface area thus obtained is in reasonable agreement with values obtained by independent methods, and that for Portland and Portland-puzzuolan cements the values are reproducible to a satisfactory degree, perhaps plus or minus 3 per cent.

An interesting paper on *The Influence of Low-Curing Temperatures on the Hardening of Cement Mortars,* by S. A. Mironoff, Central Institute for Industrial Building Research, U.S.S.R., which was presented by J. C. Pearson, Lehigh Portland Cement Co., stated the opinion that, in accordance with the theory of swelling, cement particles are hydrating in water, the hydration gradually extending from the surfaces deeper into the grains, that swelling takes place more rapidly at low temperatures (around 2 deg. C.) and that the formation of calcium-silicate gel proceeds more slowly at low temperatures, retarding the beginning of crystal formation and of intensive hardening. The paper states that the principles enumerated in the paper have been fully proved by the results of experiments.

IN another paper, *Petrographic Studies of Hydrated Cements,* L. S. Brown and R. W. Carlson, Massachusetts Institute of Technology, describe a method of making distinct thin sections of hardened cement and concrete and give results of investigations into the nature of the gel in hydrated cement, and the gel structure. The authors conclude that, as observed by microscopic examination of these sections, set cement consists mainly of three components: calcium-hydroxide crystals, calcium-silicate gel, and unhydrated cores of cement grains. The gel, which is porous, appears to fill substantially all intergranular spaces not filled by the hydroxide. Thus the degree of porosity of the gel varies with the conditions under which it is developed, particularly with the available quantity of gel-forming material as related to the volume of pores to be filled. Coarse cement and high water content produce more porous gel than do fine cement and low water content. Correspondingly, coarse cement and high water content produce large crystals of calcium hydroxide and low strength.

The paper reports that the strength of Portland cement is probably developed by the gel acting as a void-filling glue, rather than by any type of crystallization. Other things being equal, the less calcium hydroxide observed in a thin section, the greater the corresponding strength.

D. O. WOOLF, Bureau of Public Roads, described a *Cone Method for Determining the Absorption by Sand.* The paper discusses the various methods which have been used for determining the absorption by sand and indicates the difficulties and errors in these methods. The results of a co-operative series of tests, performed by twelve laboratories, in which the cone method is compared with three other absorption methods indicate that the cone method is superior to the other methods used and that it furnishes a reliable and accurate result with a minimum of equipment and working time.

In a paper on *Elastic and Thermal Expansion Properties of Concrete as Affected by Similar Properties of the Aggregate,* L. H. Koenitzer, Kansas State Agricultural College, concluded on the basis of rather extensive tests that (1) each of the ingredients that enters into a concrete mixture plays an important but somewhat unknown part in fixing the volumetric and elastic properties of the resulting concrete; (2) the elastic properties and linear change with temperature of the individual materials entering into the concrete mixture are not indicative of the results secured with the concrete mixture; (3) the elastic and thermal expansion properties of the different materials vary among themselves. For any one material those properties vary with the condition of test, the greatest variation being caused by freezing the specimen.

The reports of A.S.T.M. Committees C-9 on Concrete and Concrete Aggregates and of D-4 on Road and Paving Materials and four technical papers featured the thirteenth session of the meeting. Three new standards proposed by Committee C-9 were approved as tentative. They cover (1) a method of test for flow of concrete by use of the flow table; (2) making flexure tests using a simple beam with third point loading, and (3) determination of coal and lig-

nite in sand. New definitions were submitted as tentative covering "admixture," "gravel," "crushed stone," "blast-furnace slag," "fineness modulus," and "crushed gravel."

In a paper by F. E. Richart and J. E. Keranen, University of Illinois, the characteristic difference between Haydite and sand-gravel concrete as regards shrinkage and water loss were reported. When stored in air at 70 deg. F. and 60-per cent. relative humidity, the Haydite concrete showed extremely high water losses and relatively low shrinkage for the first two months; after 2 yr. storage the shrinkage of all-Haydite concrete slightly exceeded that of sand-gravel concrete. The shrinkage-time curves for all-Haydite concrete for the first two months were nearly straight lines, indicating a delayed or inhibited shrinkage due to the presence of a large amount of absorbed water. Due to a very large water content, the lean Haydite concrete showed more shrinkage than the richer mixtures at early ages; however, at the end of 2 yr. the richer mixture showed the greater shrinkage. The initial absorbed water in Haydite aggregate, and that absorbed during curing, may form a large part of the water content of the concrete, and will affect the water lost in air storage. Haydite concrete thus does not follow the usual relation between water loss and shrinkage.

STANTON WALKER and C. E. Proudley (National Sand & Gravel Assn.) in a paper appended to the report of Committee C-9 on the subject of *Sodium and Magnesium Sulphate Soundness Tests,* described some of their experiences in the conducting of tests for soundness. Tests were made to furnish data on the effect of variations in procedure which, in general, were within limits established in the A.S.T.M. Tentative Method of Test for Soundness of Fine Aggregates by Use of Sodium Sulphate or Magnesium Sulphate (C 88-35 T) and Tentative Method of Test for Soundness of Coarse Aggregates by Use of Sodium Sulphate or Magnesium Sulphate (C 89-35 T). The data indicated that the procedures outlined in A.S.T.M. test methods C 88-35 T and C 89-35 T are neither sufficiently definite nor restrictive to insure uniform test results. They lend support to the statement accompanying the test methods that results should be used only as a guide and not as an arbitrary basis for rejection. It seems clear that either the present methods should be surrounded with further restrictions or that another procedure, less sensitive to minor variations in technique, should be adopted. To do the first would make it difficult for the tests to be carried out as routine in the average laboratory. Particular attention should be paid to the latter alternative if testing engineers are to continue to use sodium and magnesium sulphate in accelerated soundness tests of aggregates.

AN extensive paper included as part of the C-9 Committee report, *Studies on Relation Between Characteristics of Blast-Furnace Slag and Other Coarse Aggregates and the Properties of Resultant Concretes,* by Fred Hubbard, National Slag Assn., described an investigation that was made of the physical and chemical characteristics of blast-furnace slag from sixteen commercial and four non-commercial sources, gravel from six commercial sources and crushed stone from six commercial sources. These materials were all incorporated in concrete for compression, transverse, absorption, wear and durability tests. The same sand and cement were used throughout the series and all concrete was mixed to the same consistency. Yield tests were made on a mixture containing each of the aggregates and the materials required for a cubic yard of concrete determined.

The author indicated two important facts which stand out as a result of the investigation—(1) the effect of curing on the strengths of concrete after the lapse of long periods of time, and (2) effect of the cement content of concrete on its durability. It is indicated that blast-furnace slag is a dependable and satisfactory aggregate for concrete and that it can be used with confidence that the results will be satisfactory. Hedging the material about with complicated specification limitations is meaningless, unnecessary and undesirable. The unit weight of the material is a measure of quality and a means by which only desirable slags may be accepted.

On the other hand, extremely heavy slags are no better than medium-weight slags and for some purposes less desirable than the lighter materials. A compact weight of 70 lb. per cu. ft. graded as ordinarily required for concrete aggregate will insure the acceptance of only desirable materials.

In another paper appended to the C-9 report, Messrs. Vidal and Samson, U. S. Bureau of Reclamation, Denver, Colo., describe in detail the apparatus and technique used in making permeability tests on concrete using pressures equivalent to heads of water as high as 1,000 ft. Tests were made on various sizes of specimens, the largest being 18 in. in diameter, with maximum size of aggregate 9 in.

In his paper on *Testing and Design of Stabilized Soil Mixtures,* C. A. Hogentogler, Jr., George Washington University, presented a *résumé* of the theory of soil stabilization; rôle of electro-chemical phenomena; theory and technique of the Proctor field tests and laboratory adaptation; effect of admixtures; and design of soil mixtures by means of stability tests.

A discussion of tests carried on at the Engineering Experiment Station, University of Illinois, in coöperation with A.S.T.M., was given in a paper on *The Effect of Testing Speed on Strength and Elastic Properties of Concrete,* by Messrs. Jones and Richart. Tests were made on three grades of concrete, at ages of 7 da. and 28 da. Loading of a 6-in. by 12-in. cylinder to failure was accomplished in periods of 1 sec., 5 sec., 20 sec., 1 min., 2 min., 10 min., 30 min., 1 hr., and 4 hr., with a corresponding rate of stress application ranging from 3,870 down to 0.12 lb. per sq. in. per sec. For all but the very slow loading rates autographic records of load, strain and time were taken by means of an oscillograph recorder, equipped with super-sensitive elements.

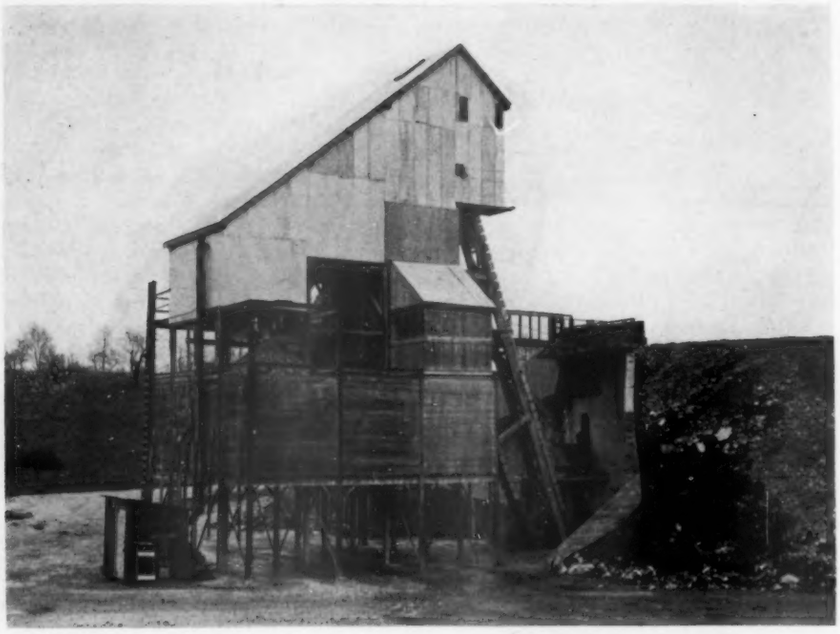
The test results indicate that the strength values obtained increase with increase in speed of loading, the ratio of strengths for the highest and lowest rates used being about 1⅓ to 1. The secant modulus of elasticity at 90 per cent. of the maximum load also increased with increase in rate of loading. This indicates that a part of the measured strain in the tests is due to creep; the amount of this creep increases with the length of time involved in the test.

PROF. W. S. HOUSEL in his paper on *Internal Stability of Granular Materials,* discussed inconsistencies which have arisen in internal-friction theories and presented the results of a series of tests on five different granular materials. In these data there is no direct relation between shearing resistance, or friction, and the principal pressures which express internal stability in a granular mass.

A general equation for ultimate bearing capacity was reported as well as an equation to represent pressure distribution and capacity at loads less than ultimate. The results of a comprehensive series of bearing-capacity tests on the same materials used in other types of tests were presented and correlated with the internal-stability relations.

The paper concludes that the behavior of granular materials under stress can be accurately and simply described in terms of the stability of elementary arches of soil particles in which the ability to sustain vertical pressure is dependent on the horizontal thrusts supplied by adjacent particles in the mass. The relation between the vertical and lateral principal pressures depends simply upon the angle of transmission between the arch axes or lines of contact between particles and the vertical axis of reference.

By W. E. TRAUFFER



Plant of Louisville Crushed Stone Co. with crushers, bucket elevator and earth-fill ramp at right.

# Big Scraper Cuts Stripping Cost at New Kentucky Stone Plant

ONE of the most interesting new crushed-stone plants which the writer has been privileged to inspect in recent months is that operated by the Louisville Crushed Stone Co. at Louisville, Ky. Many original features of design and operation combine to make this plant a simple and low-cost operation and its location places it in an enviable position for distribution to the Louisville metropolitan area. This plant, which went into operation in September, 1935, has a capacity of 90 tons per hr. It is located at Taylor and Illinois Streets about 3 mi. southeast of the business center of Louisville.

The deposit is a high grade of limestone passing all local and state specifications for concrete aggregate and has been tested to a depth of 46 ft. The overburden of hard clay averages 6 ft. in depth and is removed by means of a Le Tourneau 12-cu. yd. "Carryall" scraper drawn by a Caterpillar-75 tractor. According to F. H. Lanham, manager, stripping is done by this equipment at a cost of not over one-third of the former method. The quarry is being developed with a circular face which keeps loading operations at the same distance from the plant at all times. This method provides a steady supply of stone to the plant with the equipment in use, insuring the greatest possible economy of operation.

The quarry face has a maximum height of 40 ft. and is 300 ft. long and will increase in both dimensions as operations are developed farther into the hillside. The face is being drilled and blasted in two 20-ft. benches. An Ingersoll-Rand wagon drill, Jackhammers and Hercules 60-per cent. explosive are used. A Koehring 1¼-cu. yd. gasoline-powered shovel loads Ford V8 trucks having 3-cu. yd. dump bodies. Three trucks are now ample to keep the plant busy and more trucks will be added as the quarry face is developed. These trucks are equipped with Wood standard steel bodies which have liners of the company's own design to withstand the battering of heavy rock and, on occasion, of the shovel dipper. The interior of each body is lined with 2-in. by 6-in. oak boards laid longitudinally, each board covered by a channel-iron section. The theory is that the steel protects the wood and the wood absorbs impact shocks, the combination protecting the original truck body. According to company officials, the life of a body is greatly increased by this method.

The loaded trucks are driven to the plant up an earth-fill ramp, which has a moderate grade and at the top is 24 ft. above the quarry floor. The foot of the ramp is fanned out so that no sharp turns need to be made by the trucks regardless of which section of the quarry is being worked. The end of the fill has a concrete retaining wall which also separates the primary crusher from the screening plant.

The trucks dump their loads into the 28-in. by 36-in. Traylor Bulldog primary jaw crusher which crushes to 4-in. size and under. The crusher product is discharged direct through a chute to a 3-ft. Traylor Model T Y gyratory crusher equipped with a bell head. The opening on this crusher is varied according to the product desired but is ordinarily set at 2 in. on the closed side. The product of this crusher is discharged to a pit from which it is taken by a belt-bucket-elevator operating on 55-ft. centers.

The elevator discharges the stone on a 4-ft. by 10-ft. triple-deck Robins Gyrex screen which ordinarily uses 2¼-in.,

The 28-in. by 36-in. primary jaw crusher to which rock is discharged by truck.

The two triple-deck screens showing water spray system and special hopper.

½-in., and ¼-in. wire cloth. The material retained on the top deck (plus 2¼-in.) is chuted to a 12-in. horizontal belt-conveyor operating on 16-ft. centers which returns the oversize through a chute to the secondary crusher. The material passing through the bottom deck (minus ¼-in.) drops through a chute into a storage bin and is sold as screenings to be used principally for water-bound macadam roads. A gate in this chute allows diversion of this material to a 3-ft. by 6-ft. single-deck Allis-Chalmers screen fitted with ⅛-in. wire cloth. This screen produces ⅛-in. to ¼-in. material used for Precote asphalt. The minus ⅛-in. material is agricultural limestone. Each size of material is stored in a separate bin. The

Machine which loads sized aggregate from stock-piles into trucks.

The jaw crusher above discharges to gyratory crusher below which feeds elevator.

Looking down on the second 3-deck screen showing spray pipes.

material retained on the two lower decks of this screen (¼-in. to 2¼-in.) drops to another 4-ft. by 12-ft. triple-deck Gyrex screen. Wire cloth with 1¼-, ⅝-, and ¼-in. openings is ordinarily used on this screen which is equipped with perforated-pipe washing sprays. The wash-water passes through the lower deck of the screen to a waste flume, carrying with it only the small amount of waste. The three finished sizes of material retained on the three screen decks, known as Nos. 2, 4, and 8 stone respectively, are chuted to their respective storage bins.

Any sizes of rock desired can be produced by changing the crusher settings and the screen-cloth sizes. Additional flexibility is provided by a special receiving hopper which takes the discharge of the finishing screen. This makes it possible to discharge each of the three sizes to its respective bin or, by means of gates in the hopper, to blend any two or all three sizes and discharge the blends to separate bins. This hopper is a simple affair with only one setting for the gates, allowing only one-half of each size to be used in blending while the other half goes to its bin, but is satisfactory for the work for which it was designed.

The primary crusher is driven by a 100-hp. General Electric motor and the gyratory crusher by a 75-hp. G. E. motor, both through Cincinnati Rubber Co. "Pacemaker" flat belts. The two Robins screens are driven by 7½-hp. Fairbanks-Morse splash-proof motors through Texrope drives. The bucket-elevator is driven through Texrope by a 30-hp. G. E. motor which also drives the short return belt-conveyor through roller-chain. A building alongside the earth fill houses the two crusher motors. A Sullivan 14-in. by 8-in. by 10-in. two-stage compressor, which is driven by a 100-hp. motor, supplies the air used for quarry drilling.

The water-supply system at this plant is especially noteworthy. To insure a year-around supply a 600-ft. canal was dug from a creek to a point about 300 ft. from the plant. For its entire length this canal is considerably deeper than the creek and remains full even when the creek level drops. Shortly after the plant went into operation a 5-week dry

Pump house at end of water-supply canal. Note dual pipe-line.

The tractor-drawn scraper used to remove overburden from the deposit. Plant and earth-fill ramp in background.

spell left the creek dry for almost the entire period but the reserve supply in the canal was ample to fill the needs of the plant. Waste water from the plant is discharged into the creek at a point above the canal to allow the silt to settle out and to insure the return of the clarified water into the canal even when the creek is dry.

The pump-house at the dead end of the canal houses an American Well Works centrifugal pump having a 4-in. intake and a 6-in. discharge. The pump is driven by a 50-hp. motor operating at 3,500 r-p-m. It discharges through a 6-in. pipe to a Y which splits the flow to two 5-in. lines extending to the top of the plant. Water is being pumped

a distance of 300 ft. and elevated 40 ft. at the rate of 600 gal. per min. with a gage pressure of 70 lb. at the top of the system. The use of dual pipe-lines is estimated to have reduced the friction loss 30 per cent. below that in the usual single pipeline. The pump is direct-driven by a 50-hp. G. E. motor.

Each of the six compartments of the storage bin has a capacity of 80 tons. All hauling from the plant is done by trucks which are loaded through sliding gates under the bins. Nineteen Ford trucks owned by the company are used for delivery purposes. All truck shipments are weighed on a Fairbanks 20-ton scale at the plant office on the hill above the plant which they must pass in order to leave the property. Near the office is ample space for stock-piles which will be built up during slack seasons. A Barber-Greene loader is used to load the trucks from the stock-piles. Although there are no facilities for railway shipment at the plant the company has loading docks on sidings of the Louisville & Nashville and Southern Rys., respectively 1½ and ¼ mi. distant. Near the office is a garage and repair shop for trucks and machinery.

The main office of the Louisville Crushed Stone Co. is at the plant. It is owned by Ralph Rogers, a highway contractor who also owns the Bloomington Crushed Stone Co., Bloomington, Ind., and F. H. Lanham, a former director of the Consolidated Stone Co.

## St. Paul Meeting (from page 69)

particle are not justified. To do justice it should be said that few such penalties are now assessed. However, in some localities the requirements for gravel, as compared with those for crushed stone, lead to the inference that gravel as a class is considered as inferior to stone as a class, whereas the discrimination actually is based on differences in the characteristics of two groups of aggregates, one of which happen to be predominately gravel and the other of which happens to be predominantly crushed stone.

Obviously, such blanket discriminations, while perhaps supportable for average conditions in a particular locality, lead, when generally applied, to injustices. Any differentiation between aggregates should be made on the basis of their performance without regard to arbitrary classification. While the latter condition represents the case in most states, there still remains much work to be done in placing specifications and the design of concrete pavement slabs on a more rational basis.

*Concrete and High Temperatures.*—Broadly speaking, siliceous rocks have a higher coefficient of expansion, due to temperature, than certain other rocks. Aggregates with a high coefficient of expansion contribute to the spalling of concrete surfaces exposed to high temperatures. These facts have led to certain building-code requirements for thicker coverings and more wire mesh, for the longer protection period, when the silica content of the coarse aggregate exceeds a specified amount. As building codes are revised, these factors are being taken into consideration, guided in a large measure by the Recommended Minimum Requirements for Fire Resistance in Buildings of the Department of Commerce Building Code Committee.

Unquestionably, the mineral composition of the aggregate does have an effect on the spalling of concrete exposed to high temperatures. We are faced with the fact that these differences do exist, but: (1) Are the temperatures which are apt to be developed in a fire in a given type of building as high as those developed in the standard fire test at different periods of exposure? (2) Do the requirements for additional thickness and the use of wire mesh represent greater added protection than the differences in fire resistance justify?

The present time-temperature curve, used in rating building materials, was selected in 1918 by a conference of representatives from organizations of such prominence in the field that it is not easy to dispute their conclusions. Nevertheless I have thought, and my conviction has been supported by others, that the time-temperature curve represents a more severe condition than will be found except under the most unusual circumstances in the case of real fires. This is particularly true, I believe, for the longer periods of exposure. Siliceous gravels in fires which were usually severe have not contributed to the collapse of the buildings. It is on this basis that I think there is most room for constructive work looking toward the elimination of arbitrary discriminations between different materials.

ALEXANDER FOSTER, JR., president of the association, presided at the two days' sessions, which were attended by the following members:

Ahearn, V. P., National Sand & Gravel Assn., Washington, D. C.

Brown, W. Jess, Dixie Sand & Gravel Corp., Chattanooga, Tenn.

Carr, Bradley S., American Manganese Steel Co., Chicago Heights, Ill.

Conrades, Otto S., St. Louis Material & Supply Co., St. Louis, Mo.

Corr, Henry T., American Steel & Wire Co., St. Paul, Minn.

Davison, H. S., J. K. Davison & Bro., Pittsburgh, Pa.

Fletcher, R. C., Flint Crushed Gravel Co., Des Moines, Ia.

Foster, Alexander, Jr., Warner Co., Philadelphia, Pa.

Godsill, E. L., Twin City Iron & Wire Co., St. Paul, Minn.

Guilfoil, D. D., Sauerman Bros., Inc., Chicago, Ill.

Hill, J. Rutledge, Gifford-Hill & Co., Inc., Dallas, Tex.

La Liberte, Henry, Consolidated Materials Co., St. Louis Park, Minn.

Lemieux, E. C., Landers-Norblum-Christenson, Minneapolis, Minn.

O'Brien, Dan O., American Hoist & Derrick Co., St. Paul, Minn.

Phillips, Stanley A., PIT AND QUARRY PUBLICATIONS, Chicago, Ill.

Rockwood, Nathan C., *Rock Products*, Chicago, Ill.

Settle, Colonel J. M., Ohio River Sand Co., Louisville, Ky.

Shiely, J. L., J. L. Shiely Co., St. Paul, Minn.

Stoner, W. M., Western Sand & Gravel Co., Lincoln, Neb.

Thomas, C. E., Ideal Sand & Gravel Co., Mason City, Ia.

Undina, A. L., Consolidated Materials Co., St. Louis Park, Minn.

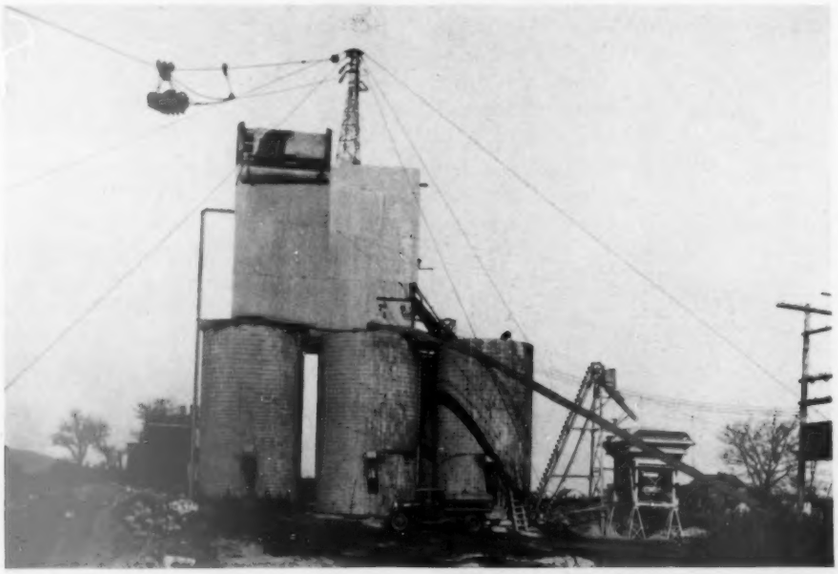
Walker, Stanton, National Sand & Gravel Assn., Washington, D. C.

West, H. E., West Sand Co., Muskogee, Okla.

Wood, Fred, Whitney, Corp., Duluth, Minn.

Young, Charles H., C. H. Young Co., St. Paul, Minn.

## NEW GRAVEL PLANT AT COLUMBUS, O.



**The new plant, above, of the Wm. Miller Sand & Gravel Co. at Columbus, O., has solved its aggregates-storage problems permanently by erecting concrete silos. These were made and installed by the Marietta Concrete Corp., Marietta, O. Other Marietta silo installations of recent date include two at the Blanchester, O., plant of C. C. Beam, Inc., and six at the plant of the Union Sand & Gravel Co., Huntington, W. Va.**

# MEN of the INDUSTRY

HARRIS N. SNYDER

MR. SNYDER was introduced to the aggregates industry just 30 years ago last month when he entered the employ of the local plant of The France Co. at Bloomville, O., where he resided. Three years later, in 1909, he went to Detroit, Mich., as manager of the France Slag Co. He remained in that capacity until 1913 when, together with L. A. Beeghly, he founded the Buffalo Slag Co., Inc., at Buffalo, N. Y., serving as secretary-treasurer and general manager from its inception. This year Mr. Snyder is serving as president of the National Slag Assn., in the affairs of which he has always been active. In addition, he is president of the Federal Crushed Stone Corp. and secretary-treasurer of the Federal Portland Cement Co., Inc., both Buffalo concerns.

# Personal Mention

F. R. McMillan, director of research, and A. J. Boase, manager, structural bureau, Portland Cement Assn., left last month for Europe where they will make an extended tour of the Continent studying concrete structures.

Richard Uhlig, operating manager of the Missouri Portland Cement Co., has been made vice-president and operating manager and has been elected to the board of directors, filling the vacancy caused by the recent death of C. A. Homer. Other changes included the promotion of Jacob Weisheyer from secretary-treasurer to vice-president and treasurer, and O. S. McArdle from sales manager to vice-president in charge of sales.

George M. Snodgrass has been appointed general sales manager of the Imperial Electric Co. of Akron, O., manufacturers of electric motors and generators. For the past 15 years Mr. Snodgrass has been with Fairbanks-Morse & Co.

Edward A. Livingstone has recently been appointed manager of alloy-tube sales for the Babcock & Wilcox Tube Co., Beaver Falls, Pa.

Stanley M. Mercier, for many years identified with sales, engineering and construction of conveying systems for the Jeffrey Mfg. Co., Columbus, O., has joined the sales and engineering staff of the Boston Woven Hose & Rubber Co.

Mr. Mercier has been in charge of many of the largest installations in all sections of the country, notably the Grand Coulee Dam, Ft. Peck Dam, the Florida Ship Canal, Ocala, Fla., and the East Boston, Mass., harbor tunnel.

James S. Lewis, Jr., has been appointed assistant construction superintendent at the Chickamauga Dam. Mr. Lewis was formerly in charge of foundation treatment at the Norris Dam.

Thomas Swan, vice-president of the Institute of Quarrying, London, England, has returned home after a tour of the United States. While at Washington, D. C., Mr. Swan visited the offices and research laboratory of the National Crushed Stone Assn.

William E. Piper, of the sales engineering staff of The Dorr Co., resigned his position as of July. He has become assistant chief engineer of the Standard Lime & Stone Company, with headquarters at Baltimore, Md.

P. Turner Scott has been made sales manager of the Georgia Cement and Products Co., Atlanta, Ga., succeeding J. M. Dannelly, who recently became vice-president.

Charles Downing, president of the Beachville Lime Quarries, Beachville, Ont., was recently chosen as one of the trustees of the Beachville Board of Education.

A. T. Brown, formerly general auditor and assistant secretary of the Caterpillar Tractor Co., has been elected a vice-president, and D. G. Sherwin, vice-president, has also been named treasurer, succeeding Henry M. Hale, who has been appointed manager of the eastern sales division.

R. A. Johnson has left Fort Peck Dam, Montana, where he was a tunnel inspector for two years, and is now acting as field engineer for The Dorr Co.

E. J. Goes, Koehring Co., was elected president of the Milwaukee Assn. of Industrial Advertisers at the annual meeting June 11, succeeding Arnold Andrews, Bucyrus-Erie Co. Delbert Kay, Nordberg Manufacturing Co., was named vice-president; Van B. Hooper, Louis Allis Co., secretary-treasurer, and Wood Sanford, Harnischfeger Co., director.

J. C. Bloomfield has joined the shovel, dragline and crane sales division of Link-Belt Co., Chicago, Ill., where he will specialize on the application of Link-Belt machines to railroad service. L. P. Spillan, for many years a member of the department, has been appointed shovel and crane division sales manager in charge of sales to contractors, with full supervision over all sales agents and distributors. N. A. Weston has been given charge of shovel division industrial sales in the Chicago sales district.

E. T. Bennington, formerly connected with the Cleveland Tramrail Co., has become a sales engineer in the Chicago office of the Harnischfeger Corp. Mr. Bennington will specialize in cranes and hoists.

G. E. Mahoney, formerly a sales engineer in the Milwaukee offices of the Chain Belt Co., has been transferred to the company's Pittsburgh office, which has been moved to the Grant Bldg.

L. W. Grothaus was recently elected vice-president of Allis-Chalmers Mfg. Company, Milwaukee, Wis. He has had 32 years of wide experience with that organization.

A. B. Fieldner, chief engineer, experiment station division, U. S. Bureau of Mines, has ben chosen as the new president of the American Society for Testing Materials. Dr. Fieldner has been with the Bureau of Mines since it was established in 1910.

P. Petri, for the past ten years engineer, maintenance of ways, of the eastern lines of the Baltimore & Ohio Railroad, has been appointed chief engineer for maintenance of the entire system, succeeding the late Earl Stimson.

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R. J. Elledge, superintendent of the Bonner Springs, Kan., plant, Lone Star Cement Corp., died in a Kansas City hospital July 27. Prior to arriving at Bonner Springs last year, Mr. Elledge built the new plant near Rio, Brazil for the International Cement Corp. He had served the corporation for many years in South America, Cuba, and at New Orleans, La., and Greencastle, Ind.

John Broderick, ranking among the oldest employees of the Broderick & Bascom Rope Co., died in St. Louis, Mo., June 2, 1936, less than three weeks before rounding out a half-century of service to his firm. He was a nephew of John J. Broderick, co-founder and first president of the company, and was born in Ireland April 23, 1864.

Joseph Walker, 80, pioneer highway contractor in New York state, died at his home at Mayfield, N. Y., on June 11. Mr. Walker had been engaged in highway construction since the late nineties when the state's first highway program was undertaken. He is credited with having built the first bituminous macadam pavement contracted for by the state.

John H. Mutchler, 60, superintendent of the Gibsonburg, O., plant of the Kelley Island Lime & Transport Co., died recently in a Toledo hospital following an extended illness.

Harry C. Fischer, 57, chief electrician at the plant of the St. Marys Cement Co., St. Marys, Ont., passed away at his home reecntly. He was a native of Breslau, Ont., and at one time was electrical inspector for the Ontario government.

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# Foreign Developments

## Study Sulphite Content and Gypsum in Clinker

From a detailed study of the $SO_3$ formed in clinker in working with sulphide-bearing raw materials, variation of the chemical composition of the clinker with varying $SO_3$ content, behavior of sulphate and sulphide sulphur in cement raw mix at different temperatures and ignition conditions, thermal dissociation of $CaSO_4$, decomposition of gypsum and chemically pure $CaSO_4$ in oxidizing conditions with Portland-cement raw mix, differences in color with manganese—and iron-bearing clinkers, effect of the $SO_3$ content on the technical properties of the cement, and solubility of $CaSO_4$ in clinker on shaking pulverized clinker with water, the author presents the following summary and conclusions:

1. In working with sulphide-bearing raw materials, clinker with higher $SO_3$ content can be burned with appropriate kiln operation.

2. Higher $SO_3$ content (up to 2 per cent.) has no injurious effect on the properties of the cement, so long as the higher $SO_3$ content is taken into account in computing the gypsum admixture.

3. Higher $SO_3$ content reduces in equivalent raw mixture the lime content of the clinker and in general also the free lime.

4. Burning temperature and $SO_3$ content stand in direct relation. At high burning temperature the $SO_3$ content is low, at lower burning temperature the $SO_3$ content becomes high. A further requisite for the formation of $SO_3$ in clinker is that the burning process be carried on with a certain excess of air. Reduction phenomena in the burning process reduce the content of $SO_3$.

5. In clinkers of the type concerned (silicate modulus 1.4—1.7, alumina modulus 1.3—1.6) the setting time can be regulated by means of higher $SO_3$ content. At an $SO_3$ content of 1.8 per cent. and thereover the clinker becomes a slow setter.

6. In improvement of soundness the $SO_3$ content shows an effect similar to gypsum. At higher content of $SO_3$ the soundness is improved as in case of gypsum.

7. In the development of strength, especially of compressive strength, gypsum cannot entirely be replaced by the $SO_3$ content. In common with gypsum, however, the heated calcium sulphate present in clinker has an effect similar to gypsum. In view of the extraordinarily fast rate of solution of gypsum and the low speed of solution of calcium sulphate in the clinker (artificial anhydrite) the combination of gypsum and artificial anhydrite is even of advantage for the development of strength and the other properties of the cement.

8. Clinkers low in $SO_3$ with gypsum swell somewhat more than clinkers high in $SO_3$ without gypsum. The degree of shrinkage of clinkers low in $SO_3$ with gypsum is somewhat less than clinkers with high $SO_3$ content, without gypsum.

9. The development of heat of the clinker in setting is only little influenced by the $SO_3$ content.

10. Of the retarders—gypsum, natural and artificial anhydrite ($CaSO_4$ in clinker)—gypsum has the greatest solubility in water.—G. Mussgnug in *Zement* 25:253-259, 268-272, April 9 and 16, 1936.

## Hydraulic Properties of High Celite Cements

Three cement raw mixtures were prepared from limestone, quartz sand, alumina and iron oxide, and were burned in a small kiln (40 x 55 x 700 cm.) of the Solo type with heavy oil. Microscopic tests of the clinker showed that the alite crystals decreased as the alumina and iron oxide of the raw mixture increased. The specific gravity of the cement was increased, the burning temperature decreased, and the setting time accelerated as the celite in the clinker increased. Also, the tensile strength of 1:3 cement-sand mortar decreased as the celite in the clinker increased.—Yoshiaki Sanada in *Journal of the Society of Chemical Industry, Japan* (Supplemental Binding) 39: 158B, May, 1936.

## Numerical Formula to Express Granular Form

It is often desirable to express in some way the predominant granular form of gravel or stone, especially for use as concrete aggregate. By visual inspection such granular forms may be grouped into four kinds: (A), spherical, polygonal and compact to cubical grains; (B), grains of still compact appearance, but without pronounced spherical form; (C), flat and long pieces with only moderately compact form; (D), pronounced flat and long forms. The first types give ordinarily a denser structure and have the lowest total surface area; the latter types in concrete work have the disadvantages of segregating and of requiring more tamping and more care when worked in dry mixes.

Attempts to obtain some numerical expression of the granular form based on the ratio of volume to minimum diameter, or of the diameter to the smallest diameter, or of the longest axis to the shortest axis, gave interesting but not entirely satisfactory results. The best method developed was to take an average sample of around 20 kg. and by repeated subdivision to separate a sample of at least 30 (better 60) grains; to measure, on each grain, the dimensions, (c) representing the longest axis, (b) the greatest diameter vertical to (c), and (a) the diameter at the center of (c) and vertical to (c) and (b); taking (a) as 1, to compute the ratios a:b:c, and to plot the results with (c) as abscisse and (b) as ordinate. Detailed examination of the results and comparison of the grouping so obtained with the grouping by visual inspection indicates that this method yields a useable indication of the granular form for practical purposes.—Dr. Kurt Walz in *Stein-Industrie und Stein-Strassenbau* 31:102-105, April 2, 1936.

## Effects of Fluorides in Synthesis of Silicates

In a preliminary study on the effects of various fluorides on the thermal synthesis of calcium silicates (following an earlier study on calcium fluoride only), the authors find that of several simple fluorides, sodium fluoride NaF is most effective; calcium fluoride $CaF_2$ is not so effective, but is used in practice in the Portland cement industry because of its availability in the natural product fluorspar and because it is the most economical of all fluorides, and magnesium fluoride $MgF_2$ is effective in the same order or a little more than calcium fluoride.

Of several complex fluorides, it was observed that the effect of addition of such complex fluorides is in the order of the part of alkali fluoride and its amount: (1) sodium alumino-fluoride or cryolite, $Na_3AlF_6$ or $3NaF.AlF_3$, (2) sodium silico-fluoride, $Na_2SiF_6$ or $2NaF.SiF_4$, and (3) magnesium silico-fluoride, $MgSiF_6$ or $MgF_2.SiF_4$. Of all fluorides, sodium alumino-fluoride or cryolite, $Na_3AlF_6$ or $3NaF.AlF_3$, is most effective, and then follow other fluorides in the order: NaF, $Na_2SiF_6$, $MgF_2$, $CaF_2$ or $MgSiF_6$.

In comparative studies using ground glass and natural feldspar, the latter was found more effective, especially for the formation of tricalcium silicate $3CaO.SiO_2$.—Shoichiro Nagai and Masamitsu Takahara in *Journal of the Society of Chemical Industry, Japan* (Supplemental Binding) 39:130B-131B, April, 1936.

# Traffic News Digest

## Legislation

*The Federal Coördinator*—The office of Federal Coördinator of Transportation which was created by the Railroad Transportation Act of 1933 expired on June 16 as Congress adjourned without having considered the resolution offered by Chairman Wheeler of the Senate Interstate Commerce Committee which would have extended this office for a period of three years and would have given the coördinator the power to issue orders requiring coördination of railroad facilities. While it was generally understood that President Roosevelt was in sympathy with this resolution, there was so much opposition from organized railroad labor, railroad management, the National Industrial Traffic League and other shippers who were not members of the League that no action was taken. On the Coördinator's staff were 187 persons who will have to seek other employment. Salaries and expenses of the Coördinator's office were paid by a tax on the railroads.

## Recent I. C. C. Decisions

*Emergency Freight Charges*—The emergency freight charges which became effective April 18, 1935, would have expired June 30, 1936, had the Commission not authorized extension of these charges with certain changes beyond that date. With a few exceptions the emergency charges have been extended for six months. The only changes which affect the non-metallic minerals industry are those on coal, rough stone, terrazzo aggregate, crushed stone, sand, gravel and other road-building materials. On coal the emergency charges were reduced one-third. On stone and road-building aggregates no emergency charge was authorized in the original report where the rate was $1.00 a net ton or less but on rates higher than $1.00 the emergency charge was 7 per cent. with a maximum of 1 c. per 100 lb. At the hearing the complaint was made that this resulted in a disadvantage to shippers whose rates were slightly higher than a dollar in competition with others having rates of $1.00 or slightly lower to the same market. For example, a rate of $1.01 is increased by the emergency charge 7 c. to $1.08, whereas the rate of $1.00 thus increases the difference from 1 c. to 8 c. To provide a more reasonable grade the Commission concluded that the rates on these commodities which are higher than $1.00 but not higher than $1.10 per net ton the emergency charge should be 4 c. The report in this reopened case is quite lengthy and deals in some detail with the general condition of the railroads throughout the country. The Commission points out that the combined rate of return on the book investments of the railroads as a whole in 1934 was 1.78 per cent. and in 1935 it was 1.93 per cent. The recovery in railroad earnings has been most marked in the eastern group. In 1935 the carriers in this group had a return of 2.67 per cent. on the Commission's valuation of their lines whereas their average for the years 1930-35 was 2.58 per cent. The rate of return in the southern region in 1935 was 1.68 per cent. compared with an average of 1.80 per cent. for 1930-35. In the western district the rate of return in 1935 was 1.45 per cent. and the average for 1930-35 was 1.76 per cent. Under the Social Security Act of 1935 the railroads will be subject to a tax of 1 per cent. of their payrolls in 1936, 2 per cent. in 1937, and 3 per cent. in 1938 and succeeding years. Based on wages paid in 1935 the estimate of additional expenses in 1936 on this account is $16,627,000. The Railroad Retirement Act of 1935 provides for an excise tax of 3.5 per cent. on railroad payrolls payable by the carriers the proceeds of which are estimated at $57,128,000 in the period from Mar. 1, 1936, to Feb. 28, 1937, based on the 1935 payrolls. In this report the Commission stresses the savings that can be made by coördination of operating facilities and states that the principal obstacles in connection with these coördinations have been removed by the agreement which has recently been reached by the railroads and their employees. A detailed report of this agreement was reported in PIT AND QUARRY for June, 1936, p. 69. The members of the Commission voted unanimously to deny the petition of the extension of the emergency charges indefinitely. The vote was seven to three to continue the charges as modified for a period of six months. The three Commissioners who dissented were of the opinion that the emergency charges should be discontinued on June 30. I. C. C. Ex Partee No. 115, Emergency Freight Charges 1935.

*Lime*—The rates on lime from Gibsonburg, Woodville and Cold Springs, O., to all points in southern territory have been found unreasonable for the future and the rates from Gibsonburg to Laurens, S. C., and Chattanooga, Tenn., have been found not unreasonable in the past but unreasonable for the future. The rates assailed in Docket Nos. 27,008, 27,012 were also found not unreasonable in the past but unreasonable for the future. Rates prescribed for the future are made on the basis of a mileage scale applied to the distance over the shortest route over which carload traffic can be moved without transfer of lading with a scale of arbitraries to be added to destinations in Florida south of the Jackson-River Junction line of the S. A. L. R. R. Provision was made for the continuance of the principal origin groups. The northern group includes Gibsonburg, Woodville, Genoa, Martin, Luckey, Tiffin, Carey and McVitty's, these being the points at which Ohio finishing lime is produced.

Rates at various intervals on the scale are shown below. These rates apply on a c.l. minimum weight of 30,000 pounds and are to alternate with rates made on a basis of 80 per cent. of the scale rates on a c.l. minimum weight of 15,000 pounds. The rates and arbitraries shown in these scales apply on a net ton.

| Miles | Rate |
|---|---|
| 90— 100 | $2.40 |
| 180— 200 | 2.90 |
| 380— 400 | 3.90 |
| 575— 600 | 4.80 |
| 950—1000 | 6.20 |
| 1350—1400 | 7.40 |

| Miles | Arbitraries |
|---|---|
| 0— 5 | $0.19 |
| 45— 50 | .44 |
| 90—100 | .60 |
| 280—300 | .85 |
| 480—500 | 1.10 |

In a dissenting opinion Commissioner Splawn said that the prescribed rates were higher mile for mile from points in Ohio to destinations in the south than were applicable between points within southern territory which were on the basis of the southern scale. He said he found no justification for requiring Ohio shippers to pay rates on their shipments to southern points higher than those paid by southern shippers for equal distances. I. C. C. Dockets No. 26,937, National Mortar & Supply Co. *v.* Pennsylvania, *et al;* No. 27,008 Laurens Glass Works, Inc. *v.* C. & W. C. *et al;* and No. 27,012 Chattanooga Glass Co. *v.* Pennsylvania *et al.*

*Lime and Limestone*—The Commission has found not justified schedules proposing to reconstruct the present rule governing mixed carloads of common lime, agricultural lime and agricultural ground or pulverized limestone between points in central territory and points in trunk line territory so as not to apply on mixed carloads of these materials to destinations in New York or via routes through New York to destinations beyond. I. C. C. I & S Docket No. 4,160 lime and limestone routed through New York state.

*Sand and Gravel*—In an effort to meet the competition of wayside sand-and-gravel pits, carriers proposed to reduce the rates on sand and gravel from Cayuga, Ind., to destinations in central Illinois. The single-line rate *via* the Nickel Plate to Mabel of 69 c., to Mortimer, Dillon and Metcalf of 70 c., and to Melwood and Brocton of 76 c., and the joint-line rates with the Kansas & Sidel R. R. and the Westfield Railroad Co. *via* Brocton of 84 c. to Borton, Warrington, Kansas, Westfield, Briscoe and Casey were all reduced in the suspended schedules to 63 c. a net ton. The Commission found that the reduction was not justified except in the rate from Cayuga to Briscoe in which wayside sand-and-gravel-pit competition existed. Carrier was authorized to publish the rate to Briscoe on one day's notice to expire Aug. 15 without reducing the rates to intermediate destinations and Fourth section order No. 12,356 was issued with the report. I. C. C. I & S Docket No. 4,202 sand and gravel from Cayuga, Ind., to Illinois.

## Examiners' Reports

*Cement*—Examiner John Davey proposes that the Commission find the rate on cement from Linwood, Ia., to Wind Lake Road, Wis., of 13 c. applied on shipments between April 21, 1934, and July 5, 1935, not unreasonable or otherwise unlawful and dismiss the complaint in I. C. C. Docket No. 27,297, Dewey Portland Cement Co. *v.* C. M. St. P. & P. *et al.*

*Feldspar*—Examiner J. Edgar Smith recommends that the Commission find the rates on feldspar from Colorado common points to destinations east of the Illinois-Indiana state line not unreasonable and that the complaint be dismissed in I. C. C. Docket No. 27,119, Western Feldspar Milling Co. *v.* Ann Arbor *et al.*

*Industrial Sand*—In a proposed report by Examiner Burton Fuller involving fifteen complaints on industrial-sand rates between points in official territory prior to July 1, 1935, he recommends that some rates be found unreasonable and that some have not been shown to be unreasonable. No recommendations are made for rates on any basis in excess of Appendix H prescribed in industrial-sand cases 1930, 188 I. C. C. 99. Rates assailed since July 1, 1935, on silica sand from Hancock, W. Va., to Baltimore, Md., and from Mapleton, Pa., to Newark, O., he proposed to be found not unreasonable. On account of the space required docket numbers and parties to these complaints are not shown here but will be furnished upon request.

*Crushed Stone, Gravel and Slag*—Railroads serving the ports of Charleston, S. C., Savannah, Ga., and Jacksonville, Fla., have been given temporary authority to maintain reduced rates to these ports in order to meet water competition without observing the long- and short-haul clause of Section Four. Competition encountered develops on materials brought by water from Chesapeake Bay, Delaware River and Hudson River points. Examiner Claude A.

(*Continued on page 85*)

# New Machinery and Supplies

## Designs Portable Apparatus to Control Rock-Drill Dust

A simple and effective portable apparatus for the control of dust from rock drilling is being marketed by the Markley Dust Control System, Inc., 415 Lexington Ave., New York, N. Y.

The principal parts of the unit are a hood covering the hole through which the drill steel passes, a preliminary settling tank which traps all the coarse dust and cuttings, a final separation tank containing bag filters and a rotary blower, powered by a gas engine, which supplies the necessary vacuum to conduct the dust away from the hole and through the separators. The various items are connecetd by lengths of 1½-in. hose. Two small or one large drill may be connected to each primary tank; one final separator and the blower will take care of two primary tanks.

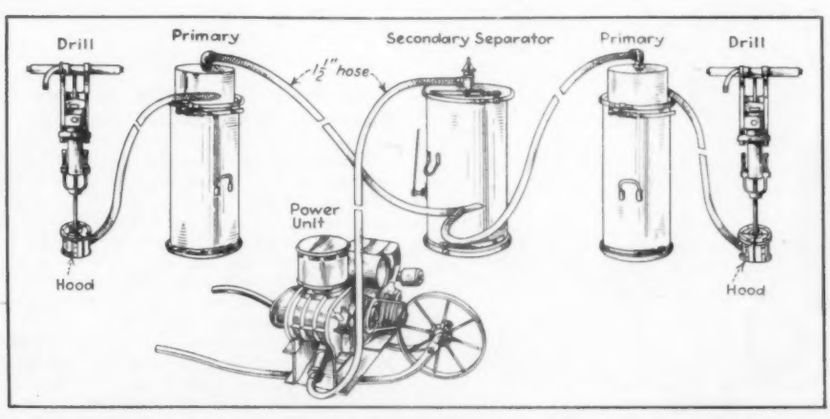
The entire unit is extremely portable and each item can be easily moved as the occasion demands. The primary tanks, 16-in. by 30-in. vertical steel cylinders of 3-cu.ft. capacity, weigh 88 lb. empty, while the final separator, a cylinder 20 in. by 30 in., carrying bag filters and a removable container of 1¼-cu.ft. capacity weighs only 90 lb. Mounted on a wheelbarrow chassis, the blower and gas-engine assembly weighs 250 lb. If powered by an air motor, this weight is reduced 120 lb.

The hood is a 6-in. pipe nipple with a 1½-in. tee connection, on top of which is a split rubber slab with wear plates through which the steel passes. A segment of the nipple is cut away on the side, the cutaway section being covered by a double-hinged rubber plate. This arrangement allows the hood to be snapped on and off the drill steel without the steel being removed from the hole, permitting the hole to be collared without the hood. The hood is instantly removed and replaced when the steel is changed.

Between 98 and 99 per cent. of the rock dust and cuttings are caught in the primary tanks. A tough pasteboard container that fits snugly within the steel cylinder of the primary tank retains the coarse dust.

From the primary separator the air stream, now carrying less than 2 per cent. of the dust, is conducted by a hose to the final separator containing the bag filters. An external shaker bar permits freeing of the trapped dust within the bags at desired intervals. The fine dust is shaken down into a shallow pasteboard container that can be removed at will and effectively sealed for disposal.

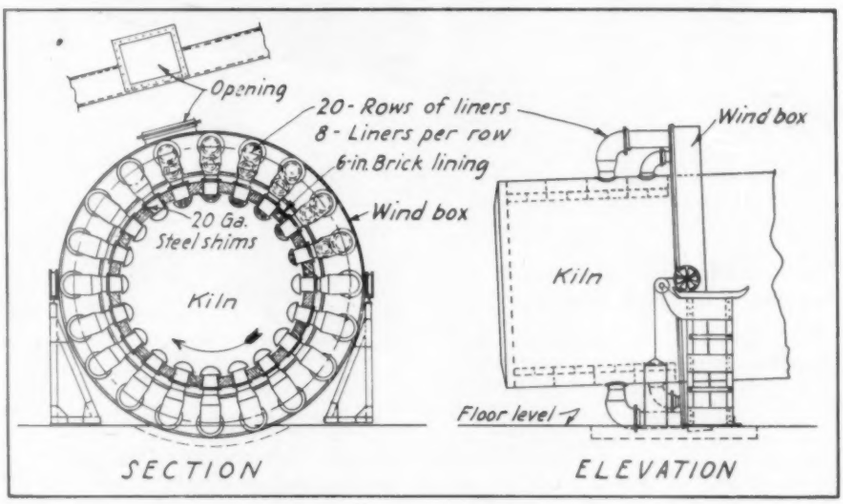
Mounted on skids, to which a wheel similar to a wheelbarrow can be attached at one end if desired, are the blower and engine. The unit is powered by a 1½-hp. gasoline-engine belt connected to the rotary blower. The blower creates a vacuum of about 4½ in. of mercury and discharges from 150 to 200 cu.ft. of air at 1-lb. pressure. Air or electric motors can drive the blower.




Diagrammatic sketch of the dust-control system ready for operation, showing proper hook-up of hose lines.

## Short-Plate Recuperator for Use on Rotary Cement Kilns

Manitowoc Engineering Works, Manitowoc, Wis., announces the new Short-Plate Type CI Vanderwerp recuperator, designed primarily for application to rotary kilns, particularly in the cement industry. As is well understood, the recuperator effects an initial cooling of the clinker prior to its discharge from the kiln, employing combustion air for the purpose, and transfers to this air the major portion of the sensible heat of the clinker. This procedure naturally results in imparting to the air a high degree of preheat—in fact, preheat temperatures as high as 1,375 deg. F. have been reported—and, as a consequence, a marked saving in fuel is accomplished, coupled with very beneficial effects in so far as improved grindability and quality of the clinker are concerned.

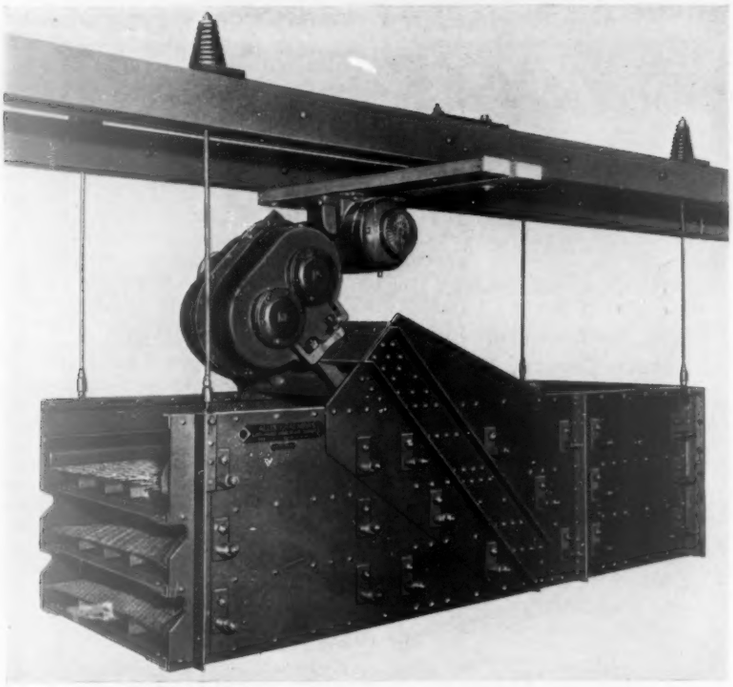



Section and elevation of recuperator on rotary kiln.

In the method of air application to the clinker, the recuperator differs from all other types of air-quenching coolers, calculated to conserve the initial heat of the clinker, in the important fact that the heat exchange between the clinker and the air is effected within the kiln itself. The manufacturer claims that it requires no extended investigation of this principle to demonstrate that the efficiency of the heat exchange is obviously a maximum when carried out in the kiln, already thoroughly insulated, by the incoming air and the refractory lining, as compared to external heat transfer which necessarily is subject to serious radiation losses. By the same token, the benefits to be derived from air-quenching necessarily reach their greatest value, it is said, when such quenching takes place at a point where exists the greatest temperature differential between the clinker and the cooling air, rather than to delay this action until such time as the clinker has had the opportunity to undergo slow, partial cooling.

Basically, this new unit does not depart essentially from previous recuperator design, but, as a result of experience gained in long service, certain refinements in detail have been incorporated and greater flexibility provided to meet any operating requirement, particularly in the matter of air distribution. Another important feature consists in the introduction of the short liner plate, having a nominal weight of but 32 lb., which plate, in effect, floats on its supporting subframe and is thoroughly air-cooled.

Operating results from recuperators employing this plate are said to be highly satisfactory and indicate that nothing further is desired in this direction. Due to the simplicity of the recuperator, which has but one moving part, maintenance is practically confined to the occasional replacement of front-row liner plates where maximum clinker temperatures are encountered. The earlier plate, which gave a good account of itself in this location, according to the manufacturer, has been superseded by this later design, assuring that maintenance costs, already low, will be still further reduced.



Improved three-deck model vibrating screen showing mounting requiring low headroom.

## Develops Special Equipment for Use in Cement Industry

Several developments and refinements in mechanical equipment for the cement industry have been made during the past year by the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

The air-quenching clinker cooler incorporates refinements which are outstanding in that uniformity of operation has been obtained without detracting from the original simplicity of the machine. The cooler is now furnished with two separate cooling air fans driven by a single motor. This dual fan arrangement not only insures a flexible means of air control but also results in a saving in power as only that portion of the air required at a relatively higher pressure is compressed to this pressure. This power economy is carried further due to the relatively thin bed of clinker which is automatically maintained on the cooling grates. An automatic blending damper is installed in conjunction with the primary air stream to maintain a constant pressure.

Another recent development by Allis-Chalmers is a combination slurry drier and kiln unit. A dense chain system is employed in drying the slurry.

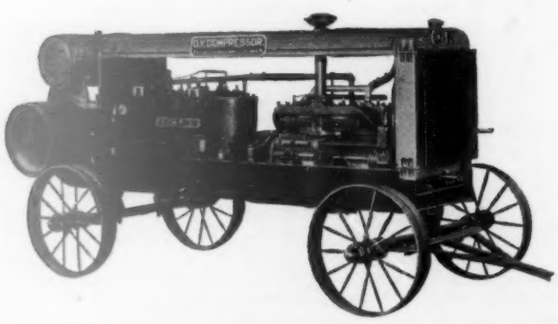
The Allis-Chalmers low-head vibrating screen, introduced some months ago, is rapidly finding favor with producers. The screen operates on a horizontal plane and the vibration is imparted by an enclosed, self-lubricating mechanism.

The above developments have been described in detail in previous issues of Pit and Quarry.

## Simple Compressor Design Makes Adjustments Easy

The primary feature desired in any air compressor is dependable operation. Realizing that a skilled mechanic is often unavailable, the O. K. Clutch & Machinery Company, Columbia, Pa., has designed a line of portable compressors that may be operated and adjusted by the ordinary workman.

The compressors are available in both one- and two-stage models. Cylinder blocks are of close-grained nickel-chrome iron, accurately machined, with water jackets extra large for efficient cooling. Main bearings are integral with the block and remain always in alignment. The crankcase is a rigid casting. Connecting rods are drop-forged, the heavy-duty automotive type. The crankshaft is a heavy drop-forging, accurately turned and ground with built-in counterweights. Pistons are of close-grained charcoal iron. Inlet and discharge valves are of the double-disk type, made of special hardened alloy steel. Lubrication is automatic and positive. The compressors are powered by gasoline or Diesel engines and vary in size from 85 to 210 cu. ft. of air per min. at 100 lb. pressure.



One of the portable air compressors. This model has a capacity of 160 cu. ft. of air per min. at 100 lb. pressure.

## New Model Bucket Loader Has Self-Propelled Mechanism

The self-propelled bucket loader shown in an accompanying illustration has been developed by the General Conveyor & Mfg. Co., of St. Louis, Mo., after considerable experimental work and will handle up to 6-in. material successfully. It will load, dig, crawl, reverse, climb under the most severe conditions and can be used for handling any bulk material such as coal, sand, gravel, crushed rock, dirt, being very mobile and always under the complete control of the operator.

The machine is supported on a three-point frame, having a single front wheel for swiveling and fan-tailing the digging end of the machine, this wheel being controlled by a large hand-wheel located in a convenient position. The propelling mechanism can be engaged or disengaged by means of a hand lever located directly alongside of the steering wheel so that the entire operation is practically confined to these two items.

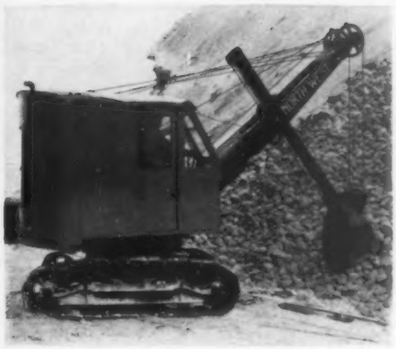
Self-propelled bucket loader.

The machine can be powered with either electric motor or gasoline engine and will handle one ton of material per minute with ease.

## Announces Two Small Model Convertible Crawler Shovels

The Northwest Engineering Co. announces two new sizes of convertible crawler shovels. These models are ⅜- and ½-cu.yd. capacities and are to be known as Models 15 and 18, respectively. Every effort has been made to incorporate the most modern features of design and construction in keeping with the requirements of the usual job encountered by machines of these capacities today.

They are full capacity, full weight, full revolving and full crawler, and the cab is a complete enclosure with space all the way around giving ample inspection room and working space for maintenance. The front part of the cab is cut away to give full vision.



Small convertible crawler-mounted shovel with full-vision cab.

The operating machinery is mounted on a rotating base casting of unusual design. Both base and side frames are cast as a unit. This assures maintenance of alignment of all shafts and bearings and provides a rigid frame for the operating machinery. The crawler base is also mounted on a casting and all travel gears are fully enclosed both top and bottom. Crawlers are of standard Northwest design having bronze-bushed, enclosed-drive-sprocket shaft bearing, roller-chain drive, with standard self-cleaning crawler tread and roller construction. Side frames are all welded.

The engine is an 8-cyl. Ford truck model with starter equipment as standard. This has been modified to meet the more rigorous service of shovel operation by several features that Northwest has found necessary over a period of years. Ford pumping equipment which consisted of only an impeller has been replaced by oversized water pumps. The radiator is of special double tank capacity. The Ford transmission has been replaced by twin-disk clutch and beyond this is a flexible coupling. A special flywheel is mounted in line with the crank shaft so that none of its torque is transmitted through the engine clutch.

The transmission is through a set of wide-faced helical gears mounted on anti-friction bearings and running in an oil-tight case. All high-speed shafts are mounted on ball or roller bearings. Standard equipment includes the "feather touch" clutch control, a Northwest device of long standing, utilizing the power of the equipment to shift the clutches, materially increasing the ease and speed of operation. This Northwest device is individual in that it makes possible "the feel" of the bucket through the operating lever. Standard equipment also includes the cushion clutch, a device on the main clutch in the hoist drum. This limits the hoist-rope pull to a definite value, transmitting the full engine power but reducing maximum stresses on every part of the machine under power when the hoist rope is tensioned.

The new models also incorporate the use of hook rollers between the rotating base and travel base. These rollers produce a result which otherwise could only be obtained by doubling the diameter of the roller path. The boom is of wide base design and is all welded. Dipper sticks also are welded. The bucket has a manganese front with removable teeth. Sheaves are of extra large size for long cable life.

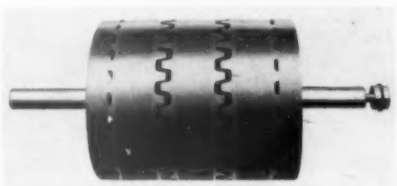
The whole shovel attachment features the Northwest Independent Crowd which utilizes the force which is in what is normally the dead-end of the hoist cable, generally dead-ended somewhere on the boom. This is a force that shovels usually waste and which results in greater crowding power and greater engine power for digging. Design is unusual in that full convertibility is made possible, both from the standpoint of changing booms so that a shovel may be changed to a crane or drag line or vice versa or also removed from its crawler base to a truck base, making possible a truck train. Thus, the pit operator can buy a crawler shovel or crane today and next year should he require it, mount the same machine on a truck for roadside-pit work.

## New Magnetic Pulley Has 50 Per Cent. More Power

The Dings Magnetic Separator Co. is offering a new design of magnetic pulley which has a 50 per cent. greater radiating surface than other structures heretofore supplied. The horizontal and radial ducts for air currents are corrugated or ribbed like the surface of an air-cooled engine cylinder.

The conveyor belt forces the air downward through the radial openings and out through the longitudinal ducts, both corrugated, and therefore presents the maximum amount of radiating surface. Heat generated in the coils is quickly conducted from them through the high conductive dynamo steel poles and cores and dissipated.

The accompanying illustration shows the corrugated radial openings centrally located in each magnetic pole. Bronze spacer rings, not steel because these short-circuit the lines of force, bridge the gap between the poles.



Magnetic pulley showing corrugated radial openings.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DIXIE Mogul Hammermills are built in forty sizes for all requirements, primary, secondary or fine reduction.

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A 24-inch magnetic pulley holds man suspended. Light steel plates were placed inside the man's shoes.

Standard equipment supplied with a magnetic pulley consists of set collars, bronze slip-rings mounted upon the shaft, double-contact brushes on each slip-ring to preclude arcing and excessive wear, a dust-proof collector ring housing and an approved steel switch cabinet with fused switch, bull's-eye indicator to show when current is flowing and a special "kick-absorbing" resistance which absorbs the counter electromotive force when the circuit is opened.

## Carrying Scraper Mounted on Larger-Size Pneumatic Tires

A new model 12-cu.yd. Type Y Carryall scraper for use with RD-8 Caterpillar tractors, has just been announced by R. G. LeTourneau, Inc., Peoria, Ill., and Stockton, Cal.

In design the new model is quite similar to the company's former 12-cu.yd. Carryall. It is cable-controlled by means of a two-drum LeTourneau power-control unit mounted at the rear of the pulling tractor. It embodies the same positive, accurate unloading method, namely, use of a sliding tailgate to force material out of the bowl. The cutting blade of 10 ft. in width, bowl dimensions, and dirt-carrying capacity are the same.

The major change is in the tire size, which has been increased from 13.50 by 20 to 18.00 by 24. The larger tires greatly reduce draft on the tractor and provide a much larger ground contact, so the new Carryall will stay on top of soft mud and fine sand where smaller-tired rigs bog down. Four 18.00 by 24 low-pressure tires are standard equipment on the Type Y, but duals on the rear and singles in the front, or duals both front and rear, are optional at extra cost.

To accommodate the larger tires, the front yoke has been heightened, resulting in greater clearance and easier turning. The return spring assembly is housed in the tailgate itself, and the reserve cable reel is mounted atop the tailgate, making it handier to pull new cable through the sheaves.

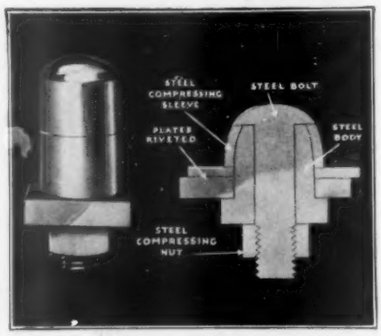
Larger tires are featured on this new 12-cu. yd. scraper.

## All-Metal Rivet Useful in Making Repairs About Plant

An all-metal Multi-Seal rivet for use in repairing, riveting and anchoring all types of equipment such as boilers, water and compressed air tanks and pipe-lines is being marketed by the Multi-Seal Mfg. Co., 123 N. Jefferson St., Chicago, Ill.

The rivet is constructed of strong lead alloy composition that forms under the pressur of drawing up the nut on a special steel bolt. A hardened brass compressor on the tip of the rivet fans outward, compressing the alloy into a rivet head on the inside. When used for sealing, three seals are thus formed, (1) by the rivet face on the inside, (2) by lateral expansion in the hole, and (3) by the square seal on the outside. The rivet forms with the contour of the metal and can be used on corners or irregular surfaces with equal success.

Laboratory tests have indicated that no rust, corrosion or electrolytic action can attack the

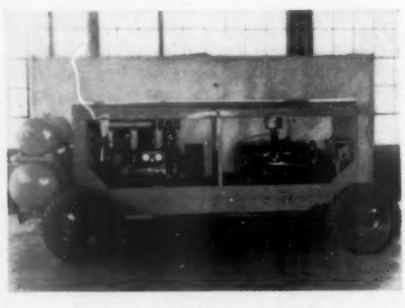



Regular and sectional views of the rivet.

Multi-Seal rivet. They are especially useful in high pressure use, such as compressed air or in boiler maintenance: The rivets come in standard boxes of one dozen in hole sizes of ¼ to ¾ in.

## Introduces Complete Line of Two-Stage Air Compressors

Having met with considerable success during the past twelve years with its line of air-cooled single-stage compressors the Davey Compres-



Two-stage completely air-cooled trailer-type compressor.

sor Co., Kent, O., recently introduced a complete line of portable two-stage compressors, also air-cooled.

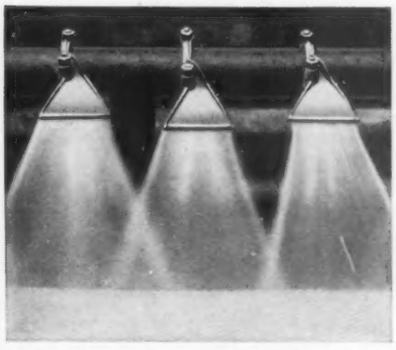
Large, separate Air-Maze oil-wetted air cleaners for each compressor head insure effective cleaning of intake air. Valves are of stainless steel which seat in aluminum alloy heads producing carbon-free operation. Other features include counterweighted and balanced crankshafts, full force-feed lubrication, multiple V-belt drive and heavy, spring-loaded twin-disk clutch.

Air delivered at 100-lb. pressure for the various models runs from 105 to 315 cu.ft. per min.

### *Deflector-Type Spray for Washing Material on Screens*

Announcement is made by Link-Belt Co. that it has developed a simple, effective non-clogging spray nozzle for spraying, washing and cleaning all kinds of materials.

It is described as a scientifically shaped, smoothly polished curved bronze deflector with



Deflectors in service. Note fan-shaped spray.

U-bolt for clamping the deflector securely to water pipe, in such a position that it is just above a plain drilled hole in the wall of the pipe. The width of deflector permits a comparatively large water jet, and thus allows fairly large dirt particles to pass through the orifice without clogging it. To assemble the deflector on pipe, it is only necessary to place it in proper position over the orifice, and then tighten the hex nuts on the U-bolt.

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Allis-Chalmers Mfg. Co., Milwaukee, Wis., has increased its appropriation of approximately $1,000,000 for enlargement of its tractor works at Springfield, Ill., by an additional $500,000 for enlarging the capacity of the light-type tractor works at its main plant in West Allis, Wis. Both projects are expected to be completed this year. H. C. Merritt is general manager of tractor division.

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Marking the third plant enlargement in little more than a year, R. G. LeTourneau, Inc., builders of Carryall scrapers and other large capacity earth-moving machinery, have started construction of an addition to the Peoria, Ill., factory that will more than double its present size and capacity. Building cost of the new unit, not including installation of new machinery, will be $75,000.

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The Osgood Co. has moved its Philadelphia office to the Wilford building, at 33rd and Arch Streets. James G. Hoag, who has been district manager in Philadelphia and adjacent territory for some time past, remains in that capacity at the new address.

# THREE FACTS

**1.** Speed of operation depends on simplicity of design, rugged construction and ample power.

**2.** Low Cost operation depends on speed plus dependability . . . . . a maximum of continuous service with a minimum of lost time due to breakdowns.

**3.** The "AMERICAN GOPHER" has all these qualities . . . . . the user's assurance of high daily output at very low cost.

Convertible as shovel, crane or dragline, and available in sizes from ½-yard to 2-yard, the "GOPHER" can be furnished with gasoline, electric or Diesel power. Write for details.

*Manufacturers of*
Gopher Shovels . . Cranes . . Draglines . . Derricks . . Locomotive Cranes . . Hoists . . Bulldozers . . Ditchers Snow Plows . . Revolver Cranes . . Crabs and Winches . . Blocks and Sheaves . . "Crosby" Wire Rope Clips

AMERICAN HOIST & DERRICK COMPANY
SAINT PAUL, MINNESOTA
AMERICAN-TERRY DERRICK COMPANY
SOUTH KEARNY, NEW JERSEY

**AMERICAN SHOVELS CRANES . . . DRAGLINES**

AMERICAN
# HAMMERMILL
CRUSHER

This powerfully built unit is a low-cost producer that puts extra profits into the American Portable Crushing Plant. Its steady, rapid reduction of the material to uniform sizes, free of slivers and chips, sets new records in tonnages and quality of product. Made in capacities from ten to 100 tons per hour. Details on request.

**AMERICAN PULVERIZER COMPANY**
**1289 Macklind Avenue** **St. Louis, Mo.**

# Trade Literature

*Marietta Storage Systems.* 16 p. (The Marietta Concrete Corp., Marietta, O.)

*O. K. Air Compressors.* 16 p. (Bulletin C-36.) O.K. Clutch & Machinery Co., Columbia, Pa.

*Davey Two-Stage Air-Cooled Compressors.* 4 p. (Davey Compressor Co., Inc., Kent, O.)

*The Link-Belt Non-Clogging Spray Nozzle.* 4 p. (Link-Belt Co., Chicago, Ill.)

*Rock Dust Control Made Simple, Safe, Positive.* 4 p. (Markley Dust Control System, Inc., New York, N. Y.)

*LeTourneau Angledozers.* 12 p. (R. G. LeTourneau, Inc., Peoria, Ill., and Stockton, Cal.)

*Worthington Direct-Injection, Vertical Four-Cycle Diesel Engines.* 4 p. (Worthington Pump & Machinery Corp., Harrison, N. J.)

*Worthington Two-Stage and Three-Stage Compressors.* 12 p. (Worthington Pump & Machinery Corp., Harrison, N. J.)

*SKF Bearings for Cranes.* 32 p. (SKF Industries, Inc., Philadelphia, Pa.)

*Nitramon—A Blasting Agent for Large Diameter Drill Holes.* (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.)

*Air-Maze Industrial Air Filter.* 4 p. (Air-Maze Corp., Cleveland, O.)

*Type SS-B Single-Stage Centrifugal Pumps.* 4 p. (Allis-Chalmers Mfg. Co., Milwaukee, Wis.)

*Good Roads Champion Vibrating Screens.* 4 p. (Good Roads Machinery Corp., Kennett Square, Pa.)

*The Story of Ten Caterpillar Diesels.* 24 p. (Caterpillar Tractor Co., Peoria, Ill.)

*Deming Pumps.* 168 p. (The Deming Co., Salem, O.)

*Raymond Bowl Mill for Pulverizing Phosphate Rock.* 8 p. (Raymond Bros. Impact Pulverizer Co., Chicago, Ill.)

*Gypsum Lath.* 12 p. (The Gypsum Assn., Chicago, Ill.)

*Quick Reference Dust-Collector Catalog.* 16 p. (The Pangborn Corp., Hagerstown, Md.)

*Jeffrey Equipment at Grand Coulee.* 16 p. (The Jeffrey Mfg. Co., Columbus, O.)

*Blaw-Knox Equipment for Industrial Proportioning.* 8 p. (Blaw-Knox Co., Pittsburgh, Pa.)

*Asphalt—Nature's Most Versatile Product.* 24 p. (The Asphalt Institute, New York, N. Y.)

*New Holland Belt Conveyors.* 4 p. (New Holland Machine Co., New Holland, Pa.)

*Two-Stage Air-Cooled Electric-Driven Portable Compressors.* 4 p. (Ingersoll-Rand Co., New York, N. Y.)

*Industrial Dust Control Through Exhaust Systems.* 54 p. (By W. O. Vedder, Pangborn Corp., Hagerstown, Md.)

*Jaeger Mixers.* 36 p. (The Jaeger Machine Co., Columbus, O.)

*Jaeger Sure-Prime Pumps.* 36 p. (The Jaeger Machine Co., Columbus, O.)

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The Audubon Wire Cloth Corp., Philadelphia, Pa., has inaugurated a new sales policy that makes it easy for producers to obtain screen cloth in any desired size quickly. Night or day letters of inquiry may be sent, collect, to the company. With these specifications at hand, the company will respond immediately with quotations and shipping date on its Vibraloy abrasive-resisting screens to meet the user's requirements.


PYRASTEEL
for high temperatures

PYRASTEEL kiln ends offer the most economical means of saving fuel. We have made many of them in one piece up to 12 ft. diameter, also in halves and in segments. The metal section is never more than 1 inch.

The kiln end illustrated has been in continuous operation since it was first installed six years ago.

**Chicago Steel Foundry Co.**
Kedzie Ave. at 38th Street
CHICAGO, ILL.
MAKERS OF ALLOY STEEL FOR 25 YEARS



PERFORATED METAL SCREENS
FOR SAND, GRAVEL STONE, ETC.
*Manufactured exactly to your specifications.*
Any size or style screen, in thickness of steel wanted with any size perforation desired.
We can promptly duplicate your present screens at lowest prices.
Prompt Shipment
CHICAGO PERFORATING CO.
2435 W. 24TH PLACE CHICAGO, ILL.
Telephone CANAL 1459


# Incorporations

LAKE SUPERIOR GRAVEL CO., Ramsay, Mich. Organized by Peter Giacherio, Ramsay, Mich.

ROBINSON LIME CORP., Detroit, Mich. Capital $50,000 of which $1,000 has been paid in.

ANACACHE ROCK CO., St. Louis, Mo. Incorporated by Frederick H. Goester and Kingsley E. Bryant. Capital $100,000.

COLUMBIA BOTTOM QUARRY, INC., Baden Station, Mo. Incorporated by Jerome Flynn and John Guerra.

MISSOULA BRICK & LIME CO., INC., Missoula, Mont. Capital $50,000. Incorporated by Walter K. and Elfieda Klose and Irvin J. Bennett.

HERMANN SILICA SAND CO., Hermann, Mo. Capital $50,000. Incorporated by C. A. Rick and F. J. McFlynn.

WAKE FOREST GRANITE CO., Wake Forest, N. C. Capital $10,000. Incorporated by Thomas Wakeman of Henderson and Z. B. Williams of Wake Forest.

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### Seeks Equipment Catalogs

Seshier Gopalakrishna, a consulting engineer in British India writes that he is desirous of receiving catalogs covering machinery and equipment used in the nonmetallic-mineral industries. His address is:

No. 14, Model Houses
Basavangudi,
Bangalore, British India

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### To Handle Western Sales

The Robins Conveying Belt Co. has made a sales agreement with the Mine & Smleter Supply Co. of Denver, Colo., Salt Lake City, Utah, and El Paso, Tex., for the sale of Robins equipment in Arizona, Colorado, Montana, New Mexico, Utah, and Wyoming and in parts of Idaho, Nebraska, South Dakota, and Texas.

# Coming Events

*July 24, 1936. Hot Springs, Va.,* Mid-summer meeting, Board of Directors, National Crushed Stone Assn. Homestead Hotel.

*September 7-11, 1936. Pittsburgh, Pa.*—Ninety-second meeting of American Chemical Society, William Penn Hotel and Carnegie Institute.

*October 5-9, 1936. Atlantic City, N. J.*—Twenty-fifth annual safety congress. W. H. Cameron, managing director, National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

## Traffic (from page 78)

Rice recommends that the present temporary rates which are from 25 c. to 30 c. a ton under the rates made in accordance with the Commission's decision in 122 I. C. C. 133 be continued. The carriers in this proceeding ask for permission to disregard the equidistant provision of Section Four, claiming that this would restrict materially the routes over which the traffic was handled or make reductions of various intermediate destinations necessary. The examiner in recommending the Fourth Section relief proposes that it shall be subject to the 50 and 70 per cent. circuity limitations. I. C. C. F. S. A. No. 16,138 and No. 16,192 crushed stone, gravel and slag to south Atlantic ports.

### New Complaints Filed

*Cement*—The rates on cement from Laramie, Wyo., to destinations on the Santa Fe R. R. in Colorado have been attacked under Sections 1 and 3 with undue preference for shippers of cement from Portland, Colo., and Chanute, Kan., alleged. New rates and reparation are sought in the complaint filed by William D. Burnett, Attorney, 215 W. 7th St., Los Angeles, Cal., in I. C. C. Docket No. 27,421, Monolith Portland Midwest Co., Los Angeles, Cal. *v.* A. T. & S. F.

*Sand*—A complaint alleging unreasonable rates and seeking reparation in connection with the rates on sand from Manumuskin (Millville), N. J., and Elnora, Ushers and Carner, N. Y., to Florin, Pa., has been filed by Abner Pollack, Practitioner, 1148 Manor Ave., New York, N. Y., in I. C. C. Docket No. 27,436, Florin Foundry & Mfg. Co., Florin, Pa., *v.* Pennsylvania-Reading Seashore Lines *et al.*

*Pick-up and Delivery*—The Commission on its own motion has initiated an investigation into the pick-up and delivery service of the Pennsylvania, Erie, Boston & Maine, and other railroads without charges on hauls of less than 260 mi. and the graded additional charges where the hauls are for greater distances. This proceeding is assigned for hearing in connection with I. N. S. No. 4,191. I. C. C. Docket No. 27,425 official territory pick-up and delivery service.

### Traffic News

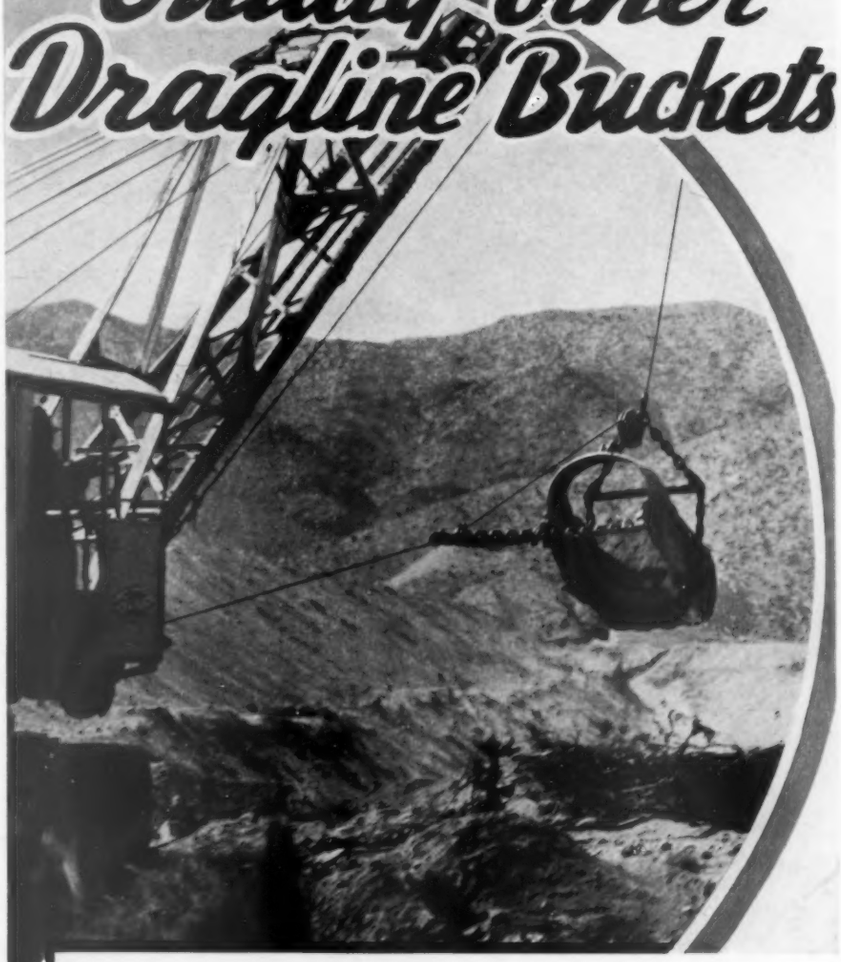
*Combination Rule on Plaster*—The respondents having filed tariffs effective May 31 complaining schedule under suspension in connection with combination rule on plaster the proceeding has been ordered discontinued in I. N. S. Docket No. 3,664.

*Truck-Rate Uniformity*—A movement is on foot to reduce the number of truck-rate bureaus and publishing agencies and to move toward a more uniform line of truck rates. These matters were taken up in Chicago at a meeting beginning June 9 attended by two or three representatives from each of the existing motor-freight bureaus. At this meeting two committees were appointed. The first was to investigate and report on the rate and classification problem and the second was to try to work out a plan for consolidating some of the existing agencies. In the complaints filed with the Commission a complaint brought by one railroad against another is quite rare. In the trucking division of transportation the complaints so far have mostly been in the nature of certain carriers complaining of the rates published by other carriers.

---

Iron & Steel Products, Inc., Chicago, dealers in railway supplies and equipment have purchased the north works of the Ryan Car Co. located in Hegewisch, Ill., a Chicago suburb. The purchase consists of all of the buildings and about 27 acres of land.


PAGE AUTOMATICS
Outdig other Dragline Buckets



**Here's Proof**

**A contractor reports:**

* *"Since using the Automatic we have been convinced that it has increased our production at least 75%."*

**A gravel plant owner says:**

* *"This bucket has speeded up our operation. It comes up with a full load when working blind under 15 ft. of water."*

**A company stripping coal writes:**

* *"Last winter we purchased an 8-cubic yard Automatic. It has increased our yardage—enabled us to dig harder burden, that we could not dig before."*

*From letters in our files.

**Ask owners—operators, they will gladly tell you about their results with Page AUTOMATICS.**

**For information on any particular size AUTOMATIC bucket, see your equipment dealer or write us direct. Address Dept. "F"**

BUILT IN SIZES 3/8 to 15 CUBIC YARDS

*"Dig with a* **PAGE AUTOMATIC***"*

**PAGE ENGINEERING COMPANY**
CLEARING POST OFFICE CHICAGO, ILLINOIS

# Greatest Annual Book Published

## JUST OUT

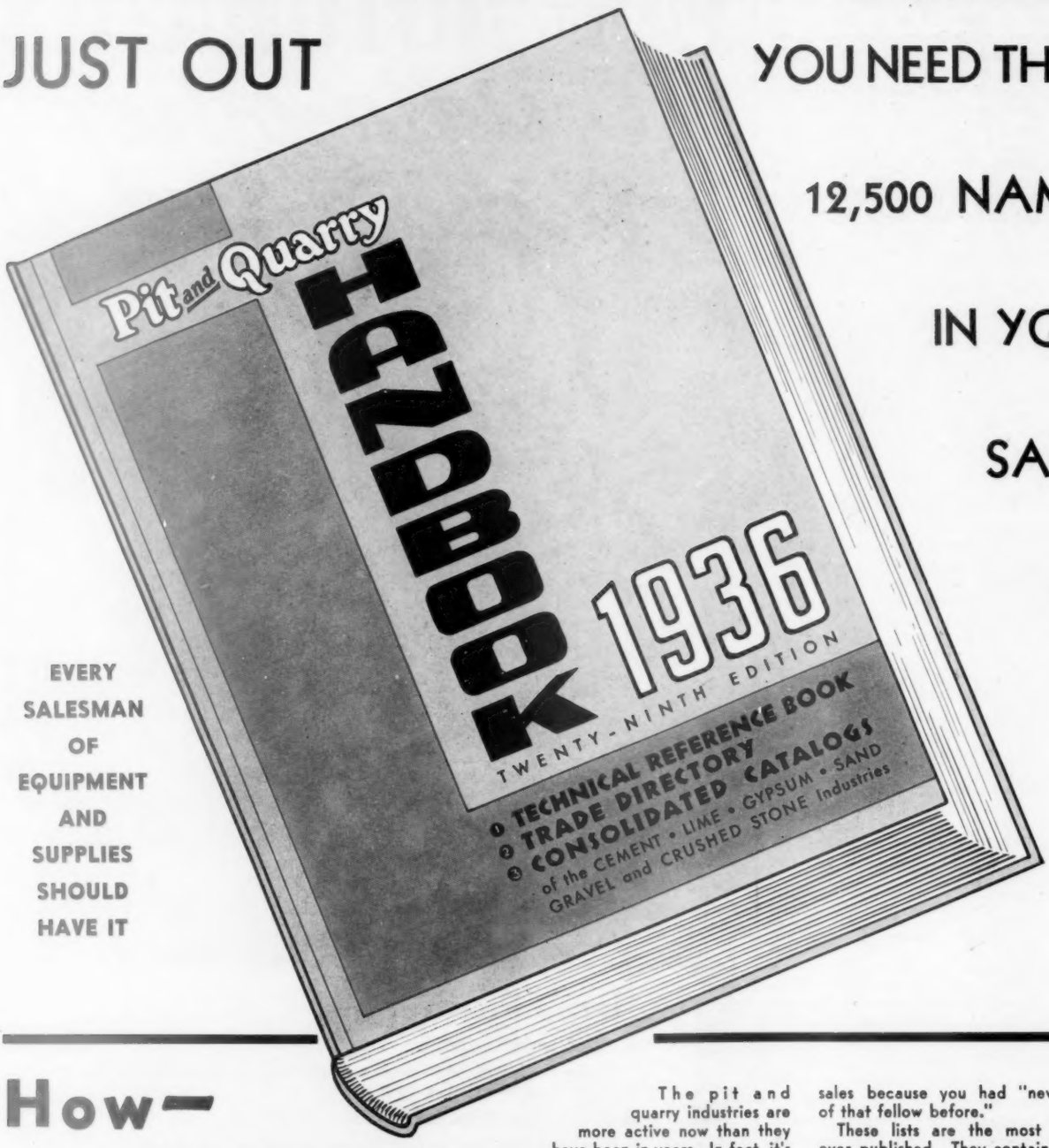
## YOU NEED THESE

## 12,500 NAMES

## IN YOUR

## SALES

## KIT




**EVERY SALESMAN OF EQUIPMENT AND SUPPLIES SHOULD HAVE IT**

## How—

*—accurate and complete are your prospect lists?*
*—accurate on individual names of Supt. and Officers?*
*—much "deadwood" is there on your prospect lists?*
*—much do you waste per year on poor lists?*
*—many "not there" calls do your men make?*
*—much do you know about new developments?*

The pit and quarry industries are more active now than they have been in years. In fact, it's one of the most active fields in industry. It's natural. For before the roads, dams, bridges, buildings, etc., can be built under the public works program the raw material has to be furnished.

Get your share of it. Don't miss fire with poor prospect lists. Don't lose sales because you had "never heard of that fellow before."

These lists are the most complete ever published. They contain hundreds of new names. They have been completely revised—all listings have been brought up to the minute.

Regardless of whether your territory covers only one state or the whole country the investment in a copy of Pit and Quarry Handbook is something that will pay big dividends—in sales.

**To Delay Is to Lose Sales—The Field Is Active—It Is Buying**

PIT AND QUARRY, 538 S. Clark St., Chicago, Ill.

☐ Send ..... copies of the 1936 Pit and Quarry Handbook and Directory ($10.00 per copy).

☐ Send ..... copies of the separately bound Pit and Quarry Directory ($10.00 per copy).

☐ Remittance Enclosed ☐ Will Remit Promptly on Receipt of Invoice.

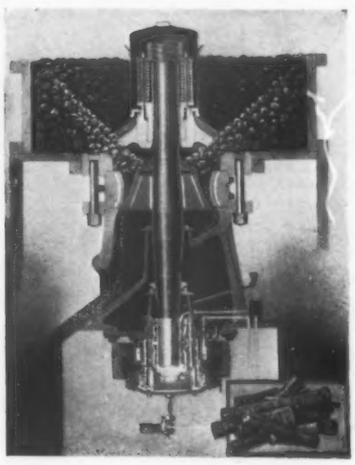
My Name ..... Title .....

Firm ..... Address ..... 7-36

# Operating figures prove the economy of these Power Savers

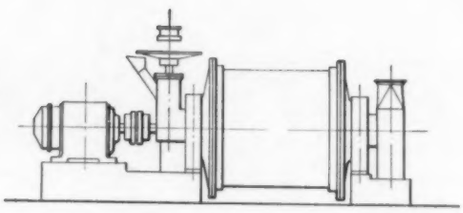
Kennedy Crushers and Screens are showing spectacular results in the production of aggregates under the hardest working conditions, in some cases doubling capacity and reducing power costs by half. The performance of this Ball Bearing Gearless Gyratory Crusher, for example, is attracting the attention of producers throughout the world. Comparative figures show actual savings of 50% in power consumption and 80% in maintenance cost.

Ask for details of this super-crushing unit.



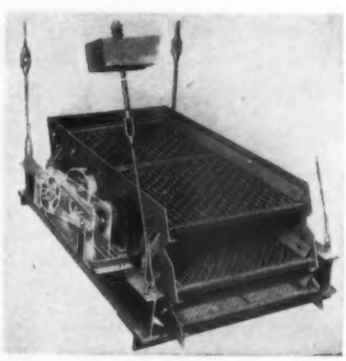
## Kennedy Ball Bearing Gearless Gyratory Crusher

## Kennedy Gearless Tube Mill



Highly efficient for grinding limestone, minerals and similar materials, also for pulverizing coal in firing kilns and boilers. Details sent on request.

## Kennedy Vibrating Screen



Does great work in scalping oversize from primary crushers, also in grading smaller sizes. Built in open or enclosed type in widths of 18" to 72" and with one or more decks, for suspension or bottom support.

**KENNEDY-VAN SAUN MFG. & ENG. CORP.**

2 Park Avenue — New York, N. Y.

Sales Agents in all Principal Cities of the United States

# Classified Buyers' Guide

## A Directory of PIT AND QUARRY Advertisers Arranged According to Product

*Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified, if brought to the attention of the Advertisers' Service Department.*

Index to Advertisers on Page 108

**Abrasives**
*Pangborn Corp.

**Aggregate-Bituminizing Plants**
Hetherington & Berner, Inc.

**Agitating Ladders (Dredge)**
*Eagle Iron Works

**Agitators, Thickness and Slurry Mixers**
*Hardinge Co.
*Manitowoc Engr. Works
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

**Air Compressors (Portable)**
*Chicago Pneumatic Tool Co.
*Fuller Co.
Gardner-Denver Co.
*Ingersoll-Rand Co.
O. K. Clutch & Machy. Co.
*Sullivan Machy. Co.
*Traylor Engr. & Mfg. Co.

**Air Compressors (Stationary)**
*Chicago Pneumatic Tool Co.
*Fuller Co.
Gardner-Denver Co.
*Ingersoll-Rand Co.
O. K. Clutch & Machy. Co.
*Sullivan Machy. Co.
*Traylor Engr. & Mfg. Co.

**Air-Conditioning Equipment**
*Pangborn Corp.

**Air Filters**
*American Air Filter Co.
*American Fdry. Equip. Co.
*Fuller Co.
*Parsons Engr. Corp.
*Sly Mfg. Co., W. W.
*Western Precipitation Co.

**Air Pumps**
*Fuller Co.
Gardner-Denver Co.
*Ingersoll-Rand Co.

**Air Separators**
Gay, Rubert M.
*Gruendler Crusher & Pulverizer Co.
*Hardinge Co.
*Pangborn Corp.
*Raymond Bros. Impact Pulv. Co.
Sturtevant Mill Co.
Universal Road Machy. Co.
Williams Patent Crusher and Pulverizer Co.

**Alloys (Steel)**
American Manganese Steel Co.
Chicago Steel Foundry Co.
Manganese Steel Forge Co.
Taylor-Wharton Iron & Steel Co.

**Ash and Refuse-Handling Equipment**
*Allen-Sherman-Hoff Co.
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link Belt Co.
*Robins Conveying Belt Co.

**Automatic Feeders**
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
*Fuller Co.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Link Belt Co.

**Automatic Weighers**
*Bartlett & Snow Co., C. O.
*Fuller Co.

**Backfillers**
*Bucyrus-Erie Co.
*Harnischfeger Corp.
*Lima Locomotive Works, Inc.
Northwest Engr. Co.

**Balls (Grinding)**
*Bartlett & Snow Co., C. O.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Manganese Steel Forge Co.
Taylor-Wharton Iron & Steel Co.

**Balls (Tube-Mill, etc.)**
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Manganese Steel Forge Co.
*Smidth & Co., F. L.

**Barges (Steel)**
*Manitowoc Engr. Works

**Bearings (Anti-Friction)**
*Bartlett & Snow Co., C. O.
Hetherington & Berner, Inc.
*Link-Belt Co.
*Robins Conveying Belt Co.

**Belting**
Goodyear Tire & Rubber Co.
Haiss Mfg. Co., Geo.
*Link-Belt Co.
Republic Rubber Co.
*Robins Conveying Belt Co.

**Belting (Multiple V)**
Goodyear Tire & Rubber Co.
Republic Rubber Co.

**Belts (Fan)**
Goodyear Tire & Rubber Co.
Republic Rubber Co.

**Bin-Dicators**
Bin-Dicator Co.

**Bin Gates**
*Allen-Sherman-Hoff Co.
*Bartlett & Snow Co., C. O.
*Fuller Co.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
Industrial Brownhoist Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Manganese Steel Forge Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.

**Bins (Cast Iron)**
*Allen-Sherman-Hoff Co.

**Bins (Concrete)**
Marietta Concrete Corp.

**Bins (Steel)**
*Bartlett & Snow Co., C. O.
*Hendrick Mfg. Co.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Manganese Steel Forge Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.

**Blast-Hole Drills (See Drills—Blast-Hole)**

**Blasting Machines**
Du Pont de Nemours & Co.

**Blasting Supplies**
Du Pont de Nemours & Co.
*Ensign-Bickford Co.

**Blocks (Sheave)**
*American Hoist & Derrick Co.
American Manganese Steel Co.
Haiss Mfg. Co., Geo.
*Sauerman Bros., Inc.

**Blowers**
*American Air Filter Co.
*Pangborn Corp.
*Sly Mfg. Co., W. W.

**Bodies (Motor Truck)**
Hug Co.

**Bodies (Motor Truck, Concrete Mixing)**
*Bartlett & Snow Co., C. O.
Jaeger Machine Co.

**Boots (Rubber)**
Goodyear Tire & Rubber Co.

**Borings, Core**
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.

**Bronze Work (Ornamental)**
*Tyler Co., W. S.

**Bucket Elevators (See Conveyors and Elevators)**

**Buckets (Clamshell, Orange-Peel, Etc.)**
*American Hoist & Derrick Co.
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Harnischfeger Corp.
Industrial Brownhoist Corp.
*Link-Belt Co.
Owen Bucket Co.
Taylor-Wharton Iron & Steel Co.

**Buckets (Dragline—Cableway)**
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Bucyrus-Erie Co.
*Link-Belt Co.
*Page Engr. Co.
*Sauerman Bros., Inc.

**Buckets (Elevator and Conveyor)**
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
Industrial Brownhoist Corp.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
Smith Engr. Works

**Buggies (Dump)**
Le Tourneau, Inc., R. G.

**Bulldozers**
Le Tourneau, Inc., R. G.

**Cableways**
*Link-Belt Co.
*Page Engr. Co.
*Roebling's Sons Co., John A.
*Sauerman Bros., Inc.

**Caps (Blasting)**
Du Pont de Nemours & Co.

**Capstans (See Winches and Capstans)**

**Car Dumpers**
Industrial Brownhoist Corp.
*Link-Belt Co.

**Car Pullers**
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.

**Carriers**
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Smith Engr. Works

**Car Wheels — (See Wheels — Car)**

**Carryalls**
Le Tourneau, Inc., R. G.

**Castings**
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Chicago Steel Foundry Co.
*Eagle Iron Works
*Hardinge Co.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
Taylor-Wharton Iron & Steel Co.

**Cement Pumps (See Pumps: Air Pumps; Pumps, Cement Slurry; Pumps, Bulk Cement)**

**Central Concrete Mixing Plants (Complete)**
*Bartlett & Snow Co., C. O.

**Chain (Dredge and Shovel)**
Manganese Steel Forge Co.

**Chain Drives**
*Link-Belt Co.

**Chain (Elevating and Conveying)**
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
Industrial Brownhoist Corp.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.

**Chute Lining (Rubber)**
Goodyear Tire & Rubber Co.

**Chutes and Chute Liners**
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
*Smidth & Co., F. L.

**Classifiers**
*Deister Machine Co.
Gay, Rubert M.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Knickerbocker Co.
Lewistown Foundry & Machine Co.
*Link-Belt Co.
*Pangborn Corp.
Sturtevant Mill Co.
Universal Road Machy. Co.

**Clips (Wire Rope)**
*American Hoist & Derrick Co.
*Roebling's Sons Co., John A.

**Clutches**
*Jeffrey Mfg. Co.
*Link-Belt Co.

**Coal-Pulverizing Equipment**
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
Gay, Rubert M.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Raymond Bros. Impact Pulv. Co.
*Smidth & Co., F. L.
Universal Road Machy. Co.
Williams Patent Crusher and Pulverizer Co.

**Compressors (See Air Compressors)**

**Concentrators (Slurry)**
*Deister Concentrator Co.

**Concrete Breakers**
*Chicago Pneumatic Tool Co.
Gardner-Denver Co.
*Ingersoll-Rand Co.
*Sullivan Machy. Co.

**Concrete Mixers**
Jaeger Machine Co.

**Condensors**
*Chicago Pneumatic Tool Co.
*Ingersoll-Rand Co.

**Cones (Sand-Washing)**
*Bartlett & Snow Co., C. O.
*Link-Belt Co.
Smith Engr. Works

**Conveyor Belting (See Belting)**

**Conveyor Idlers and Rolls**
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

**Conveyors and Elevators**
*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
*Bartlett & Snow Co., C. O.
Chicago Steel Foundry Co.
*Fuller Co.
*Gruendler Crusher & Pulverizer Co.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
Industrial Brownhoist Corp.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
*Robins Conveying Belt Co.
Smith Engr. Works
Sturtevant Mill Co.
*Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.

**Conveyors (Pneumatic)**
*Fuller Co.
Whiting Corp.

**Conveyors (Ready-Mixed Concrete)**
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
Jaeger Machine Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

**Coolers (Clinker)**
*Allis-Chalmers Mfg. Co.
*Smidth & Co., F. L.

**Coolers (See Kilns and Coolers—Rotary)**

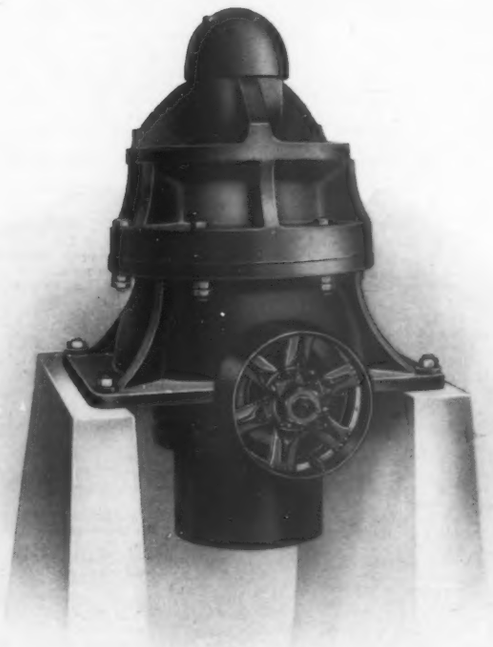
**Correcting Basins**
*Smidth & Co., F. L.

**Couplings (Hose, Pipe, Etc.)**
*Chicago Pneumatic Tool Co.
*Ingersoll-Rand Co.

**Couplings (Flexible and Shaft)**
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

*** See also information in the 1936 Pit and Quarry HANDBOOK.**

# TRAYLOR



## TYPE TY REDUCTION CRUSHER

Every other day, recently, another producer buys a TY, which WE think is "going some."

There are many reasons set forth in our Bulleti No. 112.

Write today for YOUR copy, or have our man around for a talk.

## TRAYLOR
### ENGINEERING & MFG. CO.
**Allentown, Pa.**

NEW YORK CITY
3916 Empire State Bldg.

CHICAGO
2151 One La Salle St. Bldg.

SALT LAKE CITY
101 West Second South St.

LOS ANGELES
919 Chester William Bldg.

SEATTLE
6311 22nd Ave., N. E.

Timmins, Ontario, Canada
P. O. Box 113

MANILA MACH. & SUPPLY CO.
Manila and Baguio, P. I.

Robins Conveyors (So. Africa) Inc.
Johannesburg, Transvaal, S. A.

**Export Department—104 Pearl St., New York City.**

**Foreign Sales Agencies: London, Lima, Sao Paulo, Rio de Janeiro, Buenos Aires, Santiago, Valparaiso, Antofagasta, Iquique, Oruro**

**European Works—Usines Carels Freres, Ghent, Belgium.**

# We SAVE $600 per month on power costs with our BUCKEYE!

writes W. A. ROWE
PRES. WISSOTA SAND & GRAVEL CO.

"Our Buckeye power cost averages 1.4 cents per ton of sand and gravel produced—that is about 1/3 of the cost per ton if we used electric power. So on 24,000 tons per month we figure a savings of $600.00."

That's what a Buckeye Owner says about his 260 H.P. Buckeye Diesel Power Plant.

If you are using electric or steam power investigate the savings that a Buckeye Diesel can effect for you. A Buckeye Engineer will gladly give you full details. Write today.

***Only* BUCKEYE *gives you these features:***

Silent Watchman (Patented)* Full Pressure Lubrication* Sleeve Cylinders* Silver Alloy Bearings* Completely Enclosed Construction.

## THE BUCKEYE MACHINE CO.
**LIMA, OHIO**

**ENGINE BUILDERS SINCE 1908**

**BE PROFITWISE AND DIESELIZE** *with Buckeye*

# Classified Buyers' Guide

## A Directory of PIT AND QUARRY Advertisers Arranged According to Product

Index to Advertisers on Page 108

**Cranes (Crawler and Locomotive)**
*American Hoist & Derrick Co.
*Bucyrus-Erie Co.
*Harnischfeger Corp.
Industrial Brownhoist Corp.
*Lima Locomotive Works, Inc.
*Link-Belt Co.
*Manitowoc Engr. Works
Northwest Engr. Co.
Thew Shovel Co.
Universal Crane Co.

**Cranes (Electric Traveling)**
*Harnischfeger Corp.
Industrial Brownhoist Corp.
Whiting Corp.

**Cranes (Overhead)**
*Harnischfeger Corp.
Industrial Brownhoist Corp.
Whiting Corp.

**Crusher Parts**
American Manganese Steel Co.
American Pulverizer Co.
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.
Taylor-Wharton Iron & Steel Co.

**Crushers (Cone)**
Nordberg Mfg. Co.

**Crushers (Hammer)**
*Allis-Chalmers Mfg. Co.
American Pulverizer Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
*Dixie Machy. Mfg. Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng Corp
Sturtevant Mill Co.
Williams Patent Crusher and Pulverizer Co.

**Crushers (Jaw and Gyratory)**
*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
*Bartlett & Snow Co., C. O.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
New Holland Machine Co.
Nordberg Mfg. Co.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.

**Crushers (Ring)**
American Pulverizer Co.
*Bartlett & Snow Co., C. O.
Williams Patent Crusher and Pulverizer Co.

**Crushers (Roll)**
*Allis-Chalmers Mfg. Co.
American Pulverizer Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
*Robins Conveying Belt Co.
Sturtevant Mill Co.
Williams Patent Crusher and Pulverizer Co.

**Crushers (Rotary)**
*Allis-Chalmers Mfg. Co.
American Pulverizer Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
New Holland Machine Co.

**Crushing Rolls**
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Bonnot Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
*Traylor Engr. & Mfg. Co.
Williams Patent Crusher and Pulverizer Co.

**Derricks and Derrick Fittings**
*American Hoist & Derrick Co.

**Detonators**
Du Pont de Nemours & Co.

**Diesel Engines (See Engines—Diesel)**

**Dipper Parts**
American Manganese Steel Co.
Taylor-Wharton Iron & Steel Co.

**Dippers and Teeth (Power Shovel)**
American Manganese Steel Co.
*Bucyrus-Erie Co.
Taylor-Wharton Iron & Steel Co.

**Dragline Cableway Excavators**
*American Hoist & Derrick Co.
*Bucyrus-Erie Co.
*Link-Belt Co.
*Page Engr. Co.
*Sauerman Bros., Inc.

**Dragline Excavators**
*American Hoist & Derrick Co.
*Bucyrus-Erie Co.
*Harnischfeger Corp.
Industrial Brownhoist Corp.
*Lima Locomotive Works, Inc.
*Link-Belt Co.
*Manitowoc Engr. Works
Northwest Engr. Co.
*Page Engr. Co.
Thew Shovel Co.
Universal Crane Co.

**Dredges**
*American Hoist & Derrick Co.
*Bucyrus-Erie Co.
Hetherington & Berner, Inc.
*Morris Machine Works

**Drilling Accessories**
*Chicago Pneumatic Tool Co.
Gardner-Denver Co.
*Sullivan Machy. Co.

**Drill Bits**
*Ingersoll-Rand Co.

**Drilling Contractors**
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.

**Drills (Blast-Hole)**
*Chicago Pneumatic Tool Co.
Gardner-Denver Co.
*Ingersoll-Rand Co.
*Sullivan Machy. Co.

**Drills (Core)**
Hoffman Bros. Drilling Co.
*Ingersoll-Rand Co.
Pennsylvania Drilling Co.
*Sullivan Machy. Co.

**Drills (Diamond)**
*Chicago Pneumatic Tool Co.
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.
*Sullivan Machy. Co.

**Drills (Hand-Hammer)**
*Chicago Pneumatic Tool Co.
Gardner-Denver Co.
*Sullivan Machy. Co.

**Drills (Rock)**
*Chicago Pneumatic Tool Co.
Gardner-Denver Co.
*Ingersoll-Rand Co.
*Jeffrey Mfg. Co.
*Sullivan Machy. Co.

**Drill Sharpening Machinery**
Gardner-Denver Co.
*Ingersoll-Rand Co.

**Drill Steel**
*Chicago Pneumatic Tool Co.
*Ingersoll-Rand Co.

**Drills (Well)** (See Drills—Blast-Hole)

**Drives (Multiple, Belt, Chain, Rope)**
*Allis-Chalmers Mfg. Co.

**Dryers**
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
Christie Co., L. R.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdry. & Mch. Co.
McLanahan and Stone Corp.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.

**Dust Arresters**
*American Air Filter Co.
*American Fdry. Equip. Co.
*Bartlett & Snow Co., C. O.
*Pangborn Corp.
*Parsons Engr. Co.
*Sly Mfg. Co., W. W.
*Western Precipitation Co.
Whiting Corp.

**Dust Collecting Systems**
*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
*American Air Filter Co.
*American Fdry. Equip. Co.
*Bartlett & Snow Co., C. O.
*Pangborn Corp.
*Parsons Engr. Co.
*Raymond Bros. Impact Pulv. Co.
*Sly Mfg. Co., W. W.
*Western Precipitation Co.
Whiting Corp.

**Dust Conveying Systems**
*Allen-Sherman-Hoff Co.
*American Air Filter Co.
*American Fdry. Equip. Co.
*Bartlett & Snow Co., C. O.
*Fuller Co.
*Parsons Engr. Co.
*Western Precipitation Co.

**Dust Filters**
*American Air Filter Co.
*American Fdry. Equip. Co.
*Bartlett & Snow Co., C. O.
*Pangborn Corp.
*Parsons Engr. Co.
*Sly Mfg. Co., W. W.
*Western Precipitation Co.
Whiting Corp.

**Dust Handling Systems (Hydro Vacuum)**
*Allen-Sherman-Hoff Co.

**Dynamite** (See Explosives)

**Electrical Equipment**
*Allis-Chalmers Mfg. Co.

**Electrodes (Welding)**
Stulz-Sickles Co.

**Elevator Belting** (See Belting)

**Elevators** (See Conveyors and Elevators)

**Eliminators (Soft Stone)** (See Soft Stone Eliminators)

**Engineers**
*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
*Bartlett & Snow Co., C. O.
Bonnot Co.
Christie Co., L. R.
*Fuller Co.
Hetherington & Berner, Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
*Pangborn Corp.
*Smidth & Co., F. L.
Sturtevant Mill Co.

**Engine Generator Sets**
See Generator Sets (Engine).

**Engines (Diesel)**
Buckeye Machine Co.
*Chicago Pneumatic Tool Co.
Cummins Engine Co.
*Ingersoll-Rand Co.
Nordberg Mfg. Co.
*Page Engr. Co.

**Engines (Hoisting)**
*American Hoist & Derrick Co.

**Engines (Internal-Combustion)**
Buckeye Machine Co.
*Chicago Pneumatic Tool Co.
Cummins Engine Co.
*Ingersoll-Rand Co.
Nordberg Mfg. Co.

**Engines (Steam)**
*Ingersoll-Rand Co.
*Morris Machine Works
Nordberg Mfg. Co.

**Excavating Machinery** (See Shovels; Cranes; Buckets, etc.)

**Excavators—Shallow Grading (Bucket Elevator Type)**
Haiss Mfg. Co., Geo.

**Explosives**
Du Pont de Nemours & Co.

**Fans (Exhaust)**
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.

**Feeders**
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
*Fuller Co.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
*Robins Conveying Belt Co.
Smith Engr. Works

**Floor Sweeping Systems (Hydro Vacuum)**
*Allen-Sherman-Hoff Co.

**Forges (Oil)**
Gardner-Denver Co.

**Fuses (Detonating)**
Du Pont de Nemours & Co.
*Ensign-Bickford Co.

**Gaskets**
Goodyear Tire & Rubber Co.
Republic Rubber Co.

**Gasoline Engines (See Engines—Internal-Combustion)**

**Gates (Bin)** (See Bin Gates)

**Gates (Clamshell)**
Haiss Mfg. Co., Geo.
*Link-Belt Co.

**Gears (Herringbone)**
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.

**Gears and Pinions**
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.

**Gelatin** (See Explosives)

**Generators** (See Motors and Generators)

**Glass Sand Equipment**
Lewistown Foundry & Machine Co.

**Grab Buckets** (See Buckets—Clamshell, Orange-Peel, etc.)

**Grapples**
Owen Bucket Co.

**Grating (Steel)**
*Bartlett & Snow Co., C. O.
*Hendrick Mfg. Co.

**Grinding Balls** (See Balls, Grinding)

**Grizzlies**
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
*Eagle Iron Works
*Hendrick Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdy. & Mach. Co.
Manganese Steel Forge Co.
*Robins Conveying Belt Co.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.

**Guards (Wire)**
*Bartlett & Snow Co., C. O.
Manganese Steel Forge Co.

**Guns (Hydraulic)**
Hetherington & Berner, Inc.
Taylor Forge & Pipe Works

**Hammer Mills (See Crushers—Hammer)**

**Hoists**
*American Hoist & Derrick Co.
*Bartlett & Snow Co., C. O.
*Chicago Pneumatic Tool Co.
Gardner-Denver Co.
*Harnischfeger Corp.
Hetherington & Berner, Inc.
*Ingersoll-Rand Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
O. K. Clutch & Machy. Co.
*Sauerman Bros., Inc.
Smith Engr. Works
*Sullivan Machy. Co.

**Hoppers**
*Hendrick Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.

**Hose (Air, Steam and Water)**
*Chicago Pneumatic Tool Co.
Goodyear Tire & Rubber Co.
*Ingersoll-Rand Co.
Republic Rubber Co.

**Hose (Radiator-Engine Cooling)**
Goodyear Tire & Rubber Co.
Republic Rubber Co.

**Hose Couplings (See Couplings)**

**Hydraulic Guns (See Guns—Hydraulic)**

**Idlers**
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Smith Engr. Works

**Indicators (Bin)**
Bin-Dicator Co.

*** See also information in the 1936 Pit and Quarry HANDBOOK.**

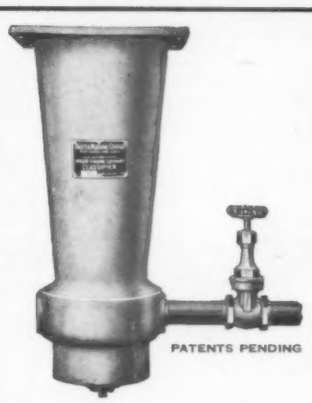
# WIRE US *your Inquiries on Wire Screens* COLLECT

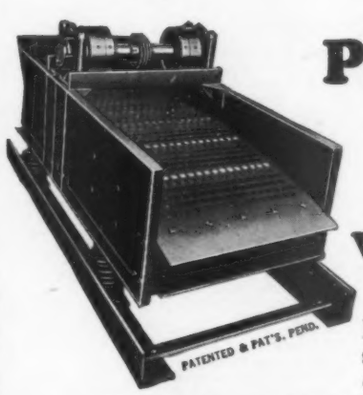
PICK UP YOUR 'PHONE AND CALL "WESTERN UNION" OR "POSTAL TELEGRAPH" AND TELL THEM NIGHT OR DAY LETTER (50 WORDS) COLLECT TO AUDUBON WIRE CLOTH CORP., CASTOR AVE. & ALLEN ST., PHILADELPHIA. WIRE US THE QUANTITY, DIMENSIONS, SIZE OF OPENING OR MESH AND DIAMETER OF WIRE OR ROD AND OTHER NECESSARY SPECIFICATIONS AND WE WILL SEND YOU A QUOTATION AND SHIPPING DATE ON VIBRALOY ABRASIVE RESISTING SCREENS IMMEDIATELY. NO OBLIGATION WHATEVER.

**COMPOUND FUNNEL CLASSIFIER**

For sizing minus 5/16" gravel and sand, and for cleaning it by washing out silt and other light impurities.

*Descriptive Bulletin No. 23*




**PLAT-O**

*Improved Heavy Duty*

**VIBRATING SCREEN**

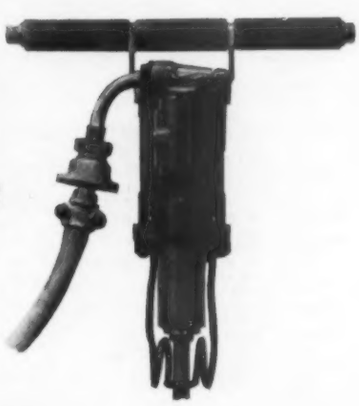
Built in all standard sizes and in from one to three decks.

*Write for Descriptive Bulletin No. 22*

**DEISTER MACHINE COMPANY**

1933 EAST WAYNE STREET FT. WAYNE, IND.

**THE NEW SULLIVAN H-2 AUGER DRILL . . .**



This machine has been designed for drilling in soft materials which tend to tie up the rotation of the average rock drill. Use it for limestone, sandstone, shale, soft, sticky ore conditions, frozen ground, coal, etc. Try one!

**SULLIVAN**

**MACHINERY COMPANY**

307 N. MICHIGAN AVE, CHICAGO, ILL.

# Classified Buyers' Guide

## A Directory of PIT AND QUARRY Advertisers Arranged According to Product

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**Kilns and Coolers (Rotary)**
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
Christie Co., L. R.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

**Kilns (Vertical)**
*Hardinge Co.

**Kominuters**
*Smidth & Co., F. L.

**Lime-Handling Equipment**
*Bartlett & Snow Co., C. O.
*Fuller Co.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Raymond Bros Impact Pulv. Co.
*Robins Conveying Belt Co.

**Lime and Hydrating Plants**
*Hardinge Co.

**Lime Kilns**
*Bartlett & Snow Co., C. O.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.

**Linings (Ball- and Tube-Mill (See Mill Liners and Linings)**

**Loaders and Unloaders**
*Bartlett & Snow Co., C. O.
*Bucyrus-Erie Co.
*Fuller Co.
Haiss Mfg. Co., Geo.
Industrial Brownhoist Corp.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

**Locomotives (Electric, Gas, Kerosene and Steam)**
*Lima Locomotive Works

**Locomotives (Trolley-Battery)**
*Jeffrey Mfg. Co.

**Magnetic Pulleys (See Pulleys, Magnetic)**

**Manganese Steel**
American Manganese Steel Co.
Manganese Steel Forge Co.
Taylor-Wharton Iron & Steel Co.

**Manganese Steel (Plates and Sheets)**
American Manganese Steel Co.
Manganese Steel Forge Co.
Taylor-Wharton Iron & Steel Co.

**Mechanical Rubber Goods**
Goodyear Tire & Rubber Co.
Republic Rubber Co.

**Mill Liners and Linings**
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Smidth & Co., F. L.

**Mills (Grinding) (See also Crushers—Hammer)**
*Allis-Chalmers Mfg. Co.
American Pulverizer Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Knickerbocker Co.
Lewistown Fdy. & Mch. Co.
*Raymond Bros. Impact Pulv. Co.
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.
Whiting Corp.
Williams Patent Crusher and Pulverizer Co.

**Motors and Generators**
*Allis-Chalmers Mfg. Co.
*Harnischfeger Corp.

**Motors (Internal-Combustion) (See Engines—Internal-Combustion)**

**Motor Trucks**
Hug Co.

**Netting (Locomotive Stack)**
Tylar Co., W. S.

**Nozzles (Gravel Washing)**
*Deister Concentrator Co.

**Nozzles (Hydraulic) (See Guns—Hydraulic)**

**Nozzles (Spray)**
*Deister Concentrator Co.

**Packings**
Goodyear Tire & Rubber Co.
Republic Rubber Co.

**Paving Mixers**
Jaeger Machine Co.

**Perforated Metal Plates**
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Chicago Perforating Co.
*Hendrick Mfg. Co.

**Pipe, Dredge (Floating and Shore)**
Taylor Forge & Pipe Works

**Pipe Flanges**
Hetherington & Berner, Inc.
Taylor Forge & Pipe Works

**Pipe Forms (Concrete)**
Quinn Wire & Iron Works

**Pipe Machines (Concrete)**
Quinn Wire & Iron Works

**Plants (Aggremeter) (See Aggremeter Plants)**

**Plug Valves (See Valves)**

**Pneumatic Conveying Systems (See Conveyors—Pneumatic)**

**Pneumatic Drills (See Drills, Rock)**

**Portable Conveyors**
*Fuller Co.
Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

**Portable Crushing and Screening Plants**
*Bartlett & Snow Co., C. O.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
Williams Patent Crusher and Pulverizer Co.

**Portable Engines (See Engines—Internal Combustion)**

**Portable Loaders (See Loaders and Unloaders)**

**Power Shovels (See Shovels, Electric, Internal-Combustion and Steam)**

**Pulverized Fuel Systems**
*Bartlett & Snow Co., C. O.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Raymond Bros. Impact Pulv. Co.

**Pulverizers (See also Crushers; Mills; etc.)**
American Pulverizer Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
Gay, Rubert M.
*Gruendler Crusher & Pulverizer Co.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Knickerbocker Co.
Lewistown Foundry & Machinery Co.
New Holland Machine Co.
*Raymond Bros. Impact Pulv. Co.
*Smidth & Co., F. L.
Sturtevant Mill Co.
Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.
Whiting Corp.
Williams Patent Crusher and Pulverizer Co.

**Pump Parts**
American Manganese Steel Co.
Taylor-Wharton Iron & Steel Co.

**Pump Valves (See Valves, Pump)**

**Pumps (Air-Lift)**
*Chicago Pneumatic Tool Co.
*Fuller Co.
*Ingersoll-Rand Co.

**Pumps (Bulk Cement)**
*Fuller Co.

**Pumps (Cement Slurry)**
*Allen-Sherman-Hoff Co.
*Morris Machine Works
*Smidth & Co., F. L.

**Pumps (Centrifugal)**
*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Hetherington & Berner, Inc.
*Ingersoll-Rand Co.
Kansas City Hay Press Co.
*Morris Machine Works

**Pumps (Dredging)**
*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Bucyrus-Erie Co.
Hetherington & Berner, Inc.
Kansas City Hay Press Co.
*Morris Machine Works

**Pumps (Sand and Gravel**
*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Hetherington & Berner, Inc.
*Ingersoll-Rand Co.
Kansas City Hay Press Co.
*Morris Machine Works

**Pumps (Sump)**
*Chicago Pneumatic Tool Co.

**Pumps (Vacuum)**
*Chicago Pneumatic Tool Co.
*Fuller Co.

**Ready-Mixed Concrete Plants**
*Bartlett & Snow Co., C. O.

**Recuperators**
*Manitowoc Engr. Wks.

**Rock Drills (See Drills—Rock)**

**Rod Mills**
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Traylor Engr. & Mfg. Co.

**Rods (Welding)**
American Manganese Steel Co.
Stulz-Sickles Co.
Taylor-Wharton Iron & Steel Co.

**Rope (Wire) (See Wire Rope)**

**Safety Appliances**
*Pangborn Corp.

**Sand-Blast Equipment**
*Pangborn Corp.

**Sand Separators**
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
Smith Engr. Works

**Sand—Lime—Brick Machinery**
*Hardinge Co.

**Sand-Settling Tanks**
*Bartlett & Snow Co., C. O.
Good Roads Machy. Corp.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Smith Engr. Works

**Scrapers (Power Drag)**
*Link-Belt Co.
*Sauerman Bros., Inc.

**Screens**
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Audubon Wire Cloth Corp.
Bacon, Inc., Earle C.
*Bartlett & Snow Co., C. O.
Chicago Perforating Co.
Cleveland Wire Cloth & Mfg. Co.
*Deister Concentrator Co.
*Deister Machine Co.
*Eagle Iron Works
Gay, Rubert M.
*Gruendler Crusher & Pulverizer Co.
Haiss Mfg. Co., Geo.
*Hardinge Co.
*Hendrick Mfg. Co.
Industrial Brownhoist Corp.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
*Link-Belt Co.
Manganese Steel Forge Co.
McLanahan and Stone Corp.
Nordberg Mfg. Co.
*Productive Equip. Corp.
*Robins Conveying Belt Co.
*Roebling's Sons Co., John A.
Smith Engr. Works
Sturtevant Mill Co.
Symons Bros. Development Co.
Taylor-Wharton Iron & Steel Co.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.
Universal Road Machy. Co.

**Screens (Vibrating or Shaking)**
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Deister Concentrator Co.
*Deister Machine Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
Nordberg Mfg. Co.
*Productive Equip. Corp.
*Robins Conveying Belt Co.
Smith Engr. Works
Sturtevant Mill Co.
Symons Bros. Development Co.
*Tyler Co., W. S.
Williams Patent Crusher and Pulverizer Co.

**Scrubbers**
Knickerbocker Co.
*Tyler Co., W. S.

**Separators (Air) (See Air Separators)**

**Separators (Slurry)**
*Smidth & Co., F. L.

**Sheaves**
*Allis-Chalmers Mfg. Co.
*American Hoist & Derrick Co.
American Manganese Steel Co.
*Eagle Iron Works
*Gruendler Crusher & Pulverizer Co.
Haiss Mfg. Co., Geo.
Hetherington & Berner, Inc.
*Link-Belt Co.
*Jeffrey Mfg. Co.
McLanahan and Stone Corp.

**Shovels (Electric, Internal-Combustion and Steam)**
*American Hoist & Derrick Co.
*Bucyrus-Erie Co.
*Harnischfeger Corp.
Industrial Brownhoist Corp.
*Lima Locomotive Wks., Inc.
*Link-Belt Co.
*Manitowoc Engr. Wks.
Northwest Engr. Co.
Thew Shovel Co.
Universal Crane Co.

**Silos**
Marietta Concrete Corp.
*Smidth & Co., F. L.

**Skip Hoists and Skips**
*Allis Chalmers Mfg. Co.
*American Hoist & Derrick Co.
*Bartlett & Snow Co., C. O.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

**Soft Stone Eliminators**
Knickerbocker Co.

**Speed Reduction Units**
*Link-Belt Co.

**Spouts (See Chutes and Chute Liners)**

**Sprays**
*Deister Concentrator Co.

**Sprockets and Chain**
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.

**Stackers**
*Jeffrey Mfg. Co.

**Steel (Alloy) (See Alloys—Steel)**

**Steel Grating (See Grating, Steel)**

**Steel Plate Construction**
Hetherington & Berner, Inc.
Manganese Steel Forge Co.
Taylor-Wharton Iron & Steel Co.

**Stokers**
Whiting Corp.

**Stone Grapples**
Owen Bucket Co.

**Storage Equipment**
Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Kern Co., Fred T.
*Link-Belt Co.
Marietta Concrete Corp.
*Sauerman Bros., Inc.

**Sweeping Systems**
*Allen-Sherman-Hoff Co.

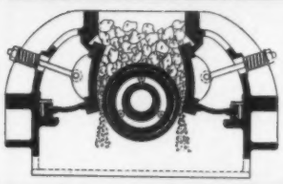
**Tanks**
*Bartlett & Snow Co., C. O.
*Hendrick Mfg. Co.
*Link-Belt Co.

*** See also information in the 1936 Pit and Quarry HANDBOOK.**

# BONNOT
## FOR
# PROFIT

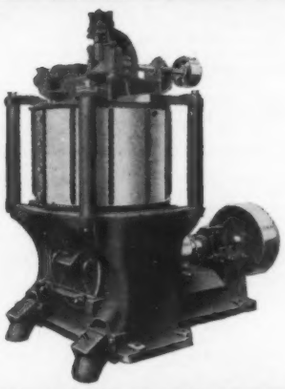
CONTINUOUS improvements in design and construction over a period of years have brought Bonnot equipment to a high degree of efficiency. The substantially lower costs of production, longer service life and lower maintenance expense, which you obtain from the use of Bonnot reduction machinery, assure larger profits for you in producing crushed or pulverized materials. Note the distinctive features in each of the following types of equipment.

## REDUCTION CRUSHERS



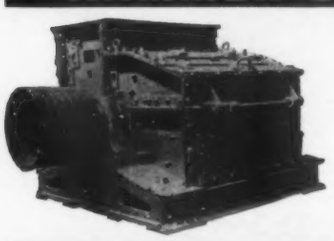
An entirely new principle of crushing, which includes the SLOW CREEP MANTLE for even distribution of wear over the crushing surfaces. Simple, rugged, and economical in power.

## PULVERIZERS, ROLL TYPE



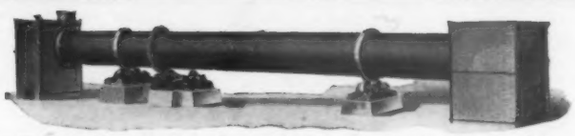
For grinding a great variety of crushed materials, including hydrated lime, quicklime, limestone, coal, clay, phosphate rock, barytes and similar products. Wearing parts few in number and easily replaced. Built in two sizes with 18 and 36-inch diameter rings.

## HAMMER CRUSHERS



Swing-hammer type for high speed operation. Oversize bearings with shafts of specially heat treated steel. Breaker plate readily adjustable and faced with manganese steel. Hammers of special alloy steels, proven superior for long, continuous service.

## ROTARY KILNS



Also Rotary Dryers, Dry Pans, Coolers, Tube Mills, Ball Mills and auxiliary equipment. Write for Bulletin of machines in which you are interested.

# THE BONNOT CO.
**CANTON** *Since 1891* **OHIO**

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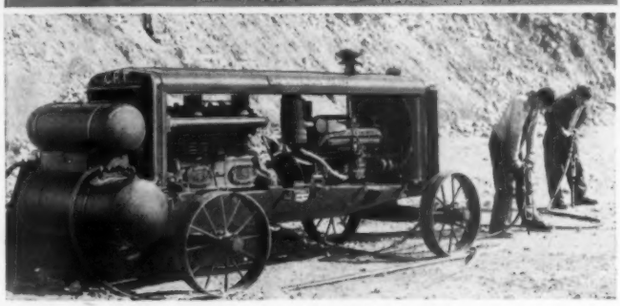
# CP PORTABLE COMPRESSORS + CP ROCK DRILLS = PROFITS



**THIS CP Two-Stage Air-Cooled Portable Gasoline-Driven Compressor and the CP-42 Sinker Drills are earning profits for a stone quarry.**

**High compressor efficiency and high drilling speed, dependability and low maintenance cost, backed by a strong service organization, enable CP Compressors and CP Drills to return profits to Contractors, Quarries and others the world over.**

**Write for Bulletin 758 which describes these outstanding compressors — gasoline and Diesel-driven — and for Bulletin 850 describing CP Sinker Drills.**

CHICAGO PNEUMATIC TOOL COMPANY
Sales and Service Branches All Over the World
**6 EAST 44th STREET • NEW YORK, N. Y.**

AIR & GAS COMPRESSORS • ROCK DRILLS
DIAMOND CORE DRILLS • DIESEL ENGINES
ELECTRIC TOOLS • PNEUMATIC TOOLS
VACUUM PUMPS & CONDENSERS
OIL WELL ROCK BITS, REAMERS & TOOL JOINTS

**CHICAGO PNEUMATIC**

C-36-3-½

# Classified Buyers' Guide

## A Directory of PIT AND QUARRY Advertisers Arranged According to Product

Index to Advertisers on Page 108

**Tanks (Sand-Settling)**
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Smith Engr. Works

**Testing Sieves and Shakers**
*Hendrick Mfg. Co.
*Tyler Co., W. S.

**Thickeners (Slurry)**
*Hardinge Co.

**Tire Repair Materials**
General Tire & Rubber Co.
Goodyear Tire & Rubber Co.

**Tires (Tractor, Truck and Passenger Car)**
General Tire & Rubber Co.
Goodyear Tire & Rubber Co.

**Tools (Drill)** (See Drilling Accessories)

**Track Shifters**
Nordberg Mfg. Co.

**Tractors**
*Allis-Chalmers Mfg. Co.

**Trailers (Motor Truck)**
Hug Co.

**Tramways (Aerial)**
*Roebling's Sons Co., John A.

**Transformers**
*Allis-Chalmers Mfg. Co.

**Transmission Belting** (See Belting)

**Transmission Machinery**
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.

**Trippers**
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

**Truck Cranes** (See Cranes)

**Truck Mixers**
*Bartlett & Snow Co., C. O.
Jaeger Machine Co.

**Trucks and Trailers** (See Motor Trucks)

**Tube-Mills** (See Mills — Ball, Tube, etc.)

**Tubes (For Tire Casings)**
General Tire & Rubber Co.
Goodyear Tire & Rubber Co.

**Underground Loaders**
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.

**Unloaders (Box Car)**
*Bartlett & Snow Co., C. O.
*Fuller Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.

**Valves (Pump)**
Taylor Forge & Pipe Works

**Variable Speed Reducers or Transmissions**
*Link-Belt Co.

**Vibrating Screen Plate**
*Bartlett & Snow Co., C. O.
Chicago Perforating Co.
*Hendrick Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.

**Vibrating Screens** (See Screens —Vibrating)

**Vibrators**
*Jeffrey Mfg. Co.
*Tyler Co., W. S.

**Wagons (Dump)**
Le Tourneau, Inc., R. G.

**Washers (Sand, Gravel and Stone)**
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Eagle Iron Works
Haiss Mfg. Co., Geo.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Knickerbocker Co.
Lewistown Foundry & Mach. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
*Smidth & Co., F. L.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.
Universal Road Machy. Co.

**Welding and Cutting Equipment**
Stulz Sickles Co.

**Welding Supplies**
American Manganese Steel Co.
*Harnischfeger Corp.
Manganese Steel Forge Co.
*Roebling's Sons Co., John A.
Stulz Sickles Co.
Taylor-Wharton Iron & Steel Co.

**Well Drills** (See Drills—Well)

**Wheels (Car)**
American Manganese Steel Co.
*Eagle Iron Works

**Wheel Rims.** See Rims—Wheel

**Winches and Capstans**
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

**Wire and Cable (Electric)**
*Roebling's Sons Co., John A.

**Wire Cloth**
Audubon Wire Cloth Corp.
Cleveland Wire Cloth & Mfg. Co.
Manganese Steel Forge Co.
*Robins Conveying Belt Co.
*Roebling's Sons Co., John A.
Taylor-Wharton Iron & Steel Co.
Tyler Co., W. S.

**Wire Rope**
Broderick & Bascom Rope Co.
*Hazard Wire Rope Co.
*Roebling's Sons Co., John A.
*Williamsport Wire Rope Co.

**Wire Rope Fittings**
*American Hoist & Derrick Co.
Broderick & Bascom Rope Co.
*Hazard Wire Rope Co.
*Page Engr. Co.
*Roebling's Sons Co., John A.
*Williamsport Wire Rope Co.

**Wire Rope Slings**
Broderick & Bascom Rope Co.
*Hazard Wire Rope Co.
*Roebling's Sons Co., John A.
*Williamsport Wire Rope Co.

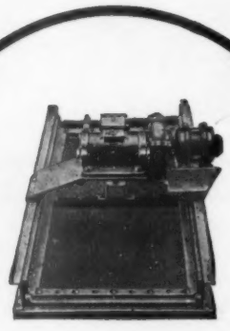
**Wire (Welding)**
American Manganese Steel Co.
Manganese Steel Forge Co.
*Roebling's Sons Co., John A.

**Worm Gears** (See Gears and Pinions)

*** See also information in the 1936 Pit and Quarry HANDBOOK.**


Fine Screening by THE Leahy

"Increased our Capacity 25 per cent"



NO-BLIND SCREEN

The experience of this operator is typical of many users of this modern NO-BLIND SCREEN:

"We are very much pleased with the Leahy Vibrating Screen. It has replaced another vibrating screen we have been using, and has increased our capacity approximately twenty-five per cent *with less than one-fourth of one per cent 'tailing'* loss. This screen now takes care of thirty tons of our product per hour with a 26-mesh No. 30 wire with 0.0245-inch openings."
—Mid Continent Glass Sand Company, Roff, Oklahoma.

Built extra sturdy.
Foolproof vibrator runs in oil.
Low maintenance, only 1% per year of the original cost.
For wet or dry screening of material from 2" to 100-mesh.

We also manufacture Sand Classifiers and the Deister Overstrom Diagonal Deck Washing Table for sand and gravel, which produces a premium product at minimum cost — handling from 18 to 40 tons per hour.

**Write for Bulletins**

**THE ORIGINAL**
**DEISTER CONCENTRATOR CO.**
Incorporated 1906
911 Glasgow Ave. Ft. Wayne, Ind.

# HAISS

—for profit and satisfaction

*That's FACT*—not fancy—as any one of the hundreds of *Haiss Loader* owners will testify. Superior design and building pay a profit to the man who spends money on *equipment to make money*. Get a Haiss quotation on the machine you need.

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142d St. & Rider Ave., New York, N. Y.
*Builders also of* HAISS ELEVATORS—SCREENS—CLAMSHELL BUCKETS



*Shrewd Buying Dictates a . . .*

**BARTLETT SNOW** *"Froth-Flotation"* **DUST COLLECTOR**

BARTLETT SNOW "Froth-Flotation" DUST COLLECTORS

• Eliminate wear, moving parts and get high recovery with a Bartlett-Snow Dust Collector. No manual supervision. No replacement of filtering units. No fire hazard. Trouble-free operation. Descriptive literature sent on request. The C. O. Bartlett & Snow Company, 6197 Harvard Avenue, Cleveland, Ohio. Representatives in the principal cities.

**BARTLETT-SNOW** *Dust Collectors*

CONVEYORS • ELEVATORS • SKIP HOISTS • FEEDERS
CHAINS • SPROCKETS • DRYERS • COOLERS • SCREENS



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Everything at your fingertips - business, shopping and amusement centers. Real comfort — real luxury—at low cost. And food to delight the most jaded palate in the Dining Room and Coffee Shop

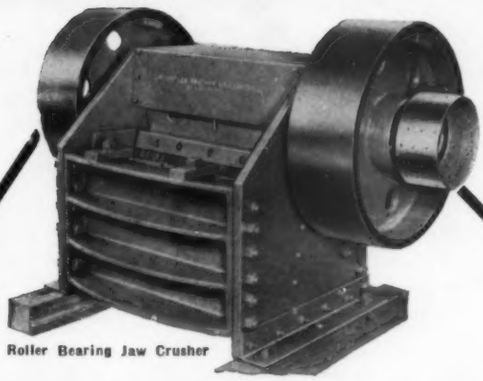
*Complete Garage Facilities*
Theodore F. Stelten – Manager

Rates from $1.50

# ANDREWS

FOURTH STREET AT HENNEPIN AVENUE . . . . . HOTEL





Roller Bearing Jaw Crusher

# GRUENDLER

**"One-Reduction" Crushing means *more production* at lower cost**

ONCE through the crusher completes the job—and out comes a uniform cubical product free of flats and ready to go—that is the Gruendler way to step up output.

The extra power and stamina of Gruendler heavy-duty roller bearing crushers are what insure higher capacity and lower maintenance, besides saving 90% in lubrication costs.

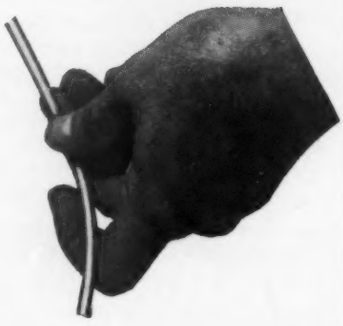
Equip for economical production now by selecting the proper Gruendler equipment for your needs.

Your inquiries are invited on crushing, screening, conveying and material handling problems.

**GRUENDLER CRUSHER & PULVERIZER COMPANY**
2915 North Market Street, Dept. PQ, ST. LOUIS, MO.

# Let's Look at Cordeau -- for Giant Blasts, et cetera

What do we mean by "et cetera"? Anything from giant blasts to single shots, with well drill, wagon drill or jackhammer holes; pocket, tunnel and broken loads; mud capping, demolition, ditching, and submarine. . . .



Look at Cordeau-Bickford Detonating Fuse **for better blasting.** Maybe you can use it profitably.

1. **More work from explosives** because the line of Cordeau acts as a detonator for **each** cartridge in the hole. The detonating wave is carried by the Cordeau.
2. **Less Hazard** because Cordeau is an insensitive detonator—a lead tube filled with **TNT.** It must be detonated: ordinary shocks do not affect it.
3. **Simplified loading** because no primers are needed in the loads.
4. **Better fragmentation** because the Cordeau hook-up can be planned to fire each hole in rotation. **The time interval is infinitesimal,** yet it serves to **relieve burden.**
5. **Equipment moved less often** because drilling can be completed and all shots fired as a single blast—with Cordeau. When drills, pipe lines, compressors, scrapers, shovels and clearing gangs can be left in position until their work has been completed, we have a decided saving in time, labor and equipment.

Send for a copy of the Cordeau Book.
There is no charge.

CORDEAU
DETONATING FUSE
BICKFORD
ALSO SAFETY FUSE *Since* 1836

CB-49
THE ENSIGN-BICKFORD COMPANY
SIMSBURY, CONNECTICUT

# COSTS GO DOWN FOR LOUISVILLE CRUSHED STONE CO.

**An overburden of hard clay to a depth of nine feet had to be stripped from the quarry of the Louisville Crushed Stone Company. Manager F. H. Lanham put a Le Tourneau 12-yard Carryall and "Caterpillar" RD8 on the job, said of the rig's performance:**

**"We estimate that the dirt moved by this machine in ten days uncovered nearly 100,000 tons of rock and at a cost of not over one-third of the old method of using the shovel and trucks."**

**Ask your "Caterpillar" tractor dealer what Le Tourneau equipment can do for you.**

R. G. LeTOURNEAU, INC.
PEORIA, ILLINOIS STOCKTON, CALIFORNIA
Cable address: "Bobletorno"

Manufacturers of: Angledozers, Buggies, Bulldozers, Carryall Scrapers, Cranes, Drag Scrapers, Power Control Units, Rooters, Semi-Trailers

LETOURNEAU

*No need to work in dust . . .*

**WE WILL SOLVE YOUR PROBLEM**

Cement
Gypsum
Lime
Crushed Stone
Silica
Brick
Marble
Slate

*Put Your Dust Suppression up to Our Engineers!*

**THE AMERICAN FOUNDRY EQUIPMENT COMPANY**

430 BYRKIT ST. MISHAWAKA, INDIANA

*Investigate* DUSTUBES



MARIETTA

**Storage Systems**

Modern engineering methods applied to large scale material handling operations . . . that's MARIETTA. Complete storage plants designed, manufactured and erected for storing and conveying COAL, SAND, GRAVEL, LIME and other bulk materials.

*Catalog on request*

The Marietta Concrete Corp.
MARIETTA, OHIO



**LINK-BELT VIBRATING SCREEN**

ALL materials, fine or coarse, light or heavy . . . clay, gravel, sand, ores, stone, etc. . . . yield to the wizardry of the mechanically-vibrated, Link-Belt Vibrating Screen, and classify themselves in strict accordance with their size. Its uniform vibration keeps the meshes open, and makes the screen's entire screening surface 100% effective. Send for Book No. 1462.

•

**LINK-BELT COMPANY** 5366

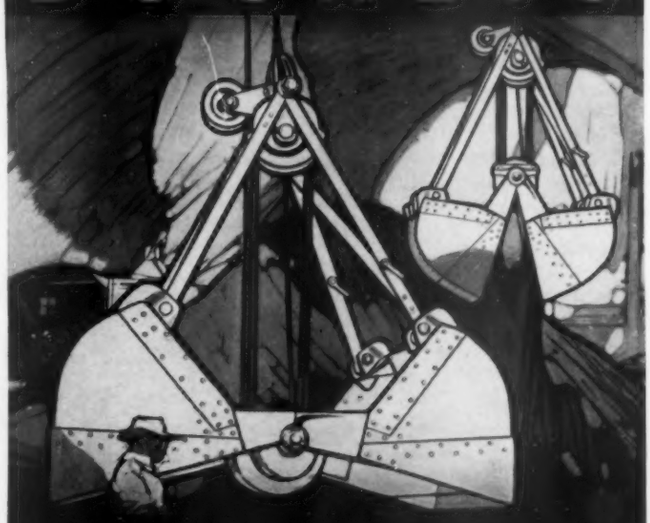
PHILADELPHIA CHICAGO INDIANAPOLIS
ATLANTA SAN FRANCISCO TORONTO

Offices in Principal Cities



ROPE-REEVE • POWER-WHEEL • LINK-TYPE

**BUCKETS**



Capacities: ½ to 15 yards for All Kinds of Light or Heavy-duty Service.

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GENERAL OFFICES: BAY CITY, MICHIGAN
New York, Philadelphia, Cleveland, Chicago
Agents in principal cities

OVAL BAG DUST ARRESTORS ✦ BLAST ROOMS ✦ OSCILLATING BLAST BARRELS ✦ EXHAUST SYSTEMS

PARSONS
PARSONS ENGINEERING CORPORATION
CLEVELAND

Parsons Oval Bag Dust Arrestors combine the advantages of the screen and cylinder types.

*Write for Bulletin DA-5.*

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Cleveland Ohio

By Preference it's DeWITT OPERATED HOTELS - Genuinely Friendly

In Cleveland it's ☐ The HOLLENDEN
In Columbus it's ☐ The NEIL HOUSE
In Dayton it's ☐ The BILTMORE
In Akron it's ☐ The MAYFLOWER
In Toledo it's ☐ The NEW SECOR
In Savannah (Ga.) it's ☐ The GEN'L OGLETHORPE
In Miami Beach it's ☐ The FLEETWOOD

DeWitt Operated Hotels feature
Unusually Comfortable Rooms at Reasonable Rates, and the Finest of Food and Beverages, Carefully Prepared and Served.

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In the production of stone, gravel, sand and slag, Symons Cone Crushers and Symons Screens meet the demand for better materials produced at a lower cost.

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HAND or WET PROCESS

Make concrete pipe on the job with Quinn Concrete Pipe Forms. Get complete information on prices and special construction features of Quinn Forms. Give us size of job for estimate on your pipe form needs.

HEAVY DUTY

Built for more years of service—sizes for any diameter pipe from 12 to 84 inches—any length—tongue and groove or bell end.

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Makes same sizes pipe as "Heavy Duty" but built to meet demand for lower cost equipment to produce uniform quality in smaller amounts.

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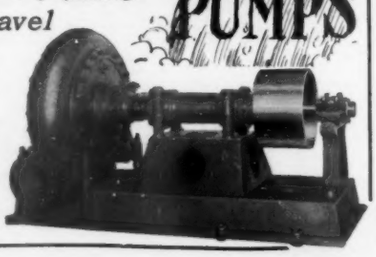
Heavy-Duty (Ball-Bearing) Sand and Gravel PUMPS



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Type "D"

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These modern up-to-the-minute models are designed for dependable performance and every feature contributes to that end: an efficient cooling system, automatic lubrication, trouble-proof valves, positive air regulation, perfect air throttle control, and most important, the use of time-proven Hercules engines.

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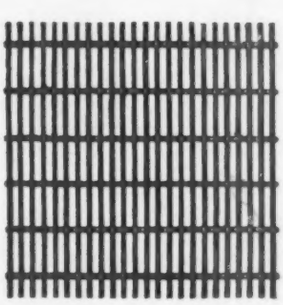

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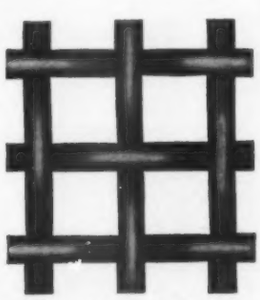
Available in Square Mesh and Rolled Slot. A trial will convince you of the superiority.



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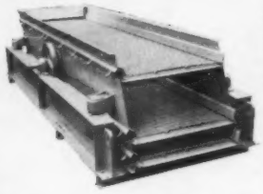

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A TYPE AND SIZE FOR EVERY JOB

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SHOVEL AND CRANE DIVISION
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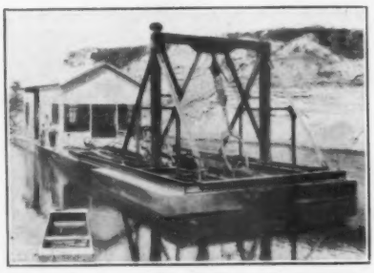

Will eliminate stoppages and slug pumping — insuring an even, constant feed of solids to the suction nozzle — with less power — greatly decreasing the cost per yard of material produced.

Write for descriptive literature and let us tell you how this can be done with your dredge.

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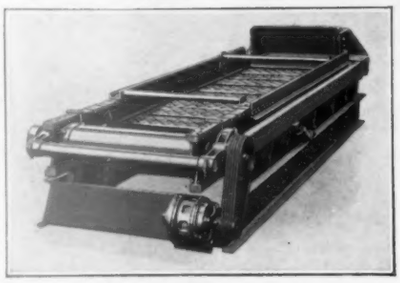

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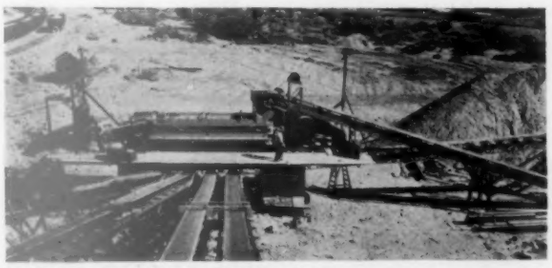

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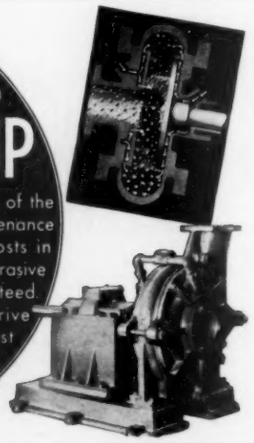

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Scraper bucket sizes range from ⅓ cu. yd. to 15 cu. yds.
Operating spans: 100 to 1500 ft. Write for Catalog.

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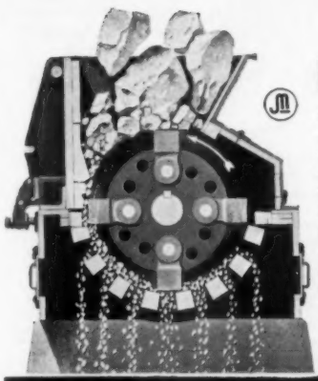

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GIVES YOU A VIBRATING SCREEN WITH—

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Processes gravel or crushed stone to meet any reasonable soundness or abrasion specification by rapid, economical, thorough elimination of soft, friable, or absorbent pieces. Remarkably low operating cost and will pay for itself quickly. Write for details.

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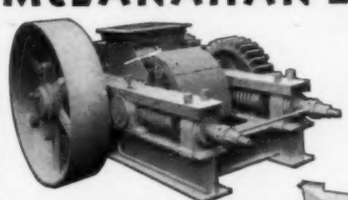

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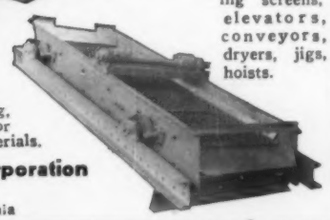
Single and double roll and jaw crushers, hammer mills, super dry pans, — steel log washers and scrubbers, sand drags, revolving and vibrating screens, elevators, conveyors, dryers, jigs, hoists.



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Complete portable, semi-portable and stationary crushing, screening and washing plants for different capacities of any materials.

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| 600 | G. E. sl. rg. | 257 |
| 600 | G. E. sl. rg. | 720 |
| 400 | West. sl. rg. | 514 |
| 300 | G. E. sl. rg. | 585 |
| 260 | Al. Ch. Syn. | 720 |
| 250 | F. M. sl. rg. | 1200 |
| 200 | West. sl. rg. | 900 |
| 200 | G. E. sl. rg. | 900 |
| 150 | G. E. sl. rg. | 1750 |
| 150 | West. sl. rg. | 720 |
| 100 | G. E. sl. rg. | 570 |
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Lot of BRAND NEW 36 in. TROUGHING & RETURN IDLERS, CHEAP.
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Clamshell, Dragline and Orange Peel Buckets; all sizes, all makes.

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6—Dragscrapers from ⅛ cu.yd. to 2-yd. size. Also Electric and Gasoline Hoists including 1—2-yd. Bucket with 120 H.P. Gasoline Hoist. Several 1-yd. and 2-yd. Sauerman Cableway Excavator outfits including:

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Large lot including std. ga. 6 and 12-yd. and 20-yd., 36-ga. 5-yd., and 24-ga. 1½-yd. Also std. ga. flat cars and ballast cars.

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1—Set P & M crushing rolls, size 42"x16".

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Steel and wood, stiff leg, or guy; from 2 to 50 tons, including 2 steel stiff legs.

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55—Electric, ranging from 20 H.P. up to 125 H.P., consisting of triple-drum, double-drum and single-drum with A.C. or D.C. mtrs., some with attached swingers.

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1—8" Morris; 1—6" Morris manganese; 1—6" Erie; 1—4" Morris.

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3—Link-Belt Shovel Attachments for K-55, K-44, K-42, K-38, K-2.

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15—Sullivan plug and feather drills.
30—"BARRE" carving tools, BL, CL, DL.
Send us a list of your Surplus equipment

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## FOR SALE

2—Class 14 Bucyrus 2 yard Draglines.

1—Monighan 2 yard Draglines.

1—Marion 37 Combination Shovel and Crane.

1—1 yard Heavy Duty Osgood Gas Shovel.

1—Erie "B" Combination Shovel, Crane and Dragline.

3—Model 3 Northwest Shovels and Cranes.

3—11x16—36 in. gauge Locomotives.

1—10x16—36 in. gauge Locomotive.

2—3 ton, 24 in. gauge Gasoline Locomotive.

1—30 Caterpillar Bulldozer.

33—4 yard, 36 in. gauge dump cars.

**H. KLEINHANS COMPANY**
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Pittsburgh, Pa.

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## FOR SALE
### LIQUIDATION AT NEW CASTLE, PA.

1—6 ft. 6 in. x 75 ft. Mosser Rotary Kiln complete.
1—Raymond Midget three roller Mill.
1—Erie City 150 HP Economic type boiler.
1—Jeffrey Conveyor System (25 ft. bucket elevator, 2—20 ft. and 50 ft. Drag Conveyors).
20—Motors, 5 to 50 HP., 3 ph. 60 cy., 220 v.
1—Carrier four truck Tunnel Ejector Dryer.
1—10-ton Howe Truck Scale.
1—Allis-Chalmers No. 6K Gyratory Crusher.
1—Set Traylor Crushing Rolls, 30 in. x 14 in.
2—Rotary Screens, 3 ft. x 10 ft., 4 ft. x 16 ft.
1—4½ ft. x 12 ft. Abbe Tube Mill.
40—Tons 100 lb. Rail; Switches.
**Miscellaneous Pumps, Bucket and Belt Conveyors, Shafting, Piping, Conduit, etc.**
**Inspection Invited! Prices on Request!**

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Jaw Crushers—2"x4" up to 66"x84".
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Rotary Fine Crushers—No. 1, No. 1½, No. 2.
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Hardinge—Marcy & Fuller-Lehigh Mills.
Raymond Mills—No. 00, No. 0 and No. 1.
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P&H Model 700 gasoline crawler type, 1¼ Yd. 45' boom.
NORTHWEST ⅞ Yd. gasoline shovel, late model track.
MARION Model 480 electric 2 Yd. shovel, late model.
NORTHWEST Model 105, ¾ Yd. dragline, Cummins Diesel, 40' boom.
P&H Model 600 gasoline crawler crane, 52' boom.
WILLIAMS 1 Yd. Favorite Clamshell bucket.
LORAIN Model 75-B, 1¼ Yd. gasoline crawler type shovel.
BALDWIN 6 wheel switcher type locomotive with separate tender, 58 tons, cylinders 19x24, Walschaert Valve Gear, 10'8" W. B.
27 ton AMERICAN 4 driver saddle tank locomotive, air brakes.
32 ton AMERICAN 4 driver saddle tank locomotive, steam brakes.
22 ton DAVENPORT 4 driver saddle tank locomotive, steam brakes.
22 ton VULCAN 36" gauge 4 driver saddle tank, new 1925.
2—12 ton 36" gauge PLYMOUTH gasoline locomotives.
20—WESTERN 36" gauge 5 Yd. 2-way side dump cars.
5—K&J all steel 20 Yd. automatic side dump cars.
LINCOLN-BUDA 300 Amp. Portable Electric Welding Machine.

**SOUTHERN IRON & EQUIPMENT CO.**
Plant & Gen. Offices, Atlanta, Georgia

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## BARGAINS

25—5-yard Western Dump Cars, 36" Gauge.

3—18-ton Vulcan Dinky Steam Locomotives, 36" Gauge.

1—Model O Nordberg Track Shifter, 36" Gauge.

2—40-ton Baldwin Switching Locomotives, Standard Gauge.

All in first-class condition; cars overhauled and locomotives completely rebuilt. Priced for quick sale.

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Buda 35 HP 4-cylinder Engine with Pulley.
Centrifugal Electric Pump, 8" inlet, 6" outlet.
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Chain Elevators with 10" and 12" buckets.
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Domestic 6" Self-Priming Pump, Waukesha Engine.
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700 Selected Belt Idlers, 18" to 36".
Robins 24"x115' Conveyor with Belt.
Robins 24" Skeleton Trough Conveyors.
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Owen ⅜-yard Clamshell Bucket.
Star Welder, 4-cyl. LeRoi, 220 Amperes.

G. A. UNVERZAGT
15 Park Row New York City, N. Y.

**MOTORS**
**3 PH. 60 CY.**

| Hp. | Type | RPM |
|---|---|---|
| 1000 | G. E. sl. rg. | 300 |
| 750 | El.Machy.Syn. | 514 |
| 700 | G. E. sl. rg. | 400 |
| 500 | G. E. sl. rg. | 450 |
| 400 | G. E. sl. rg. | 600 |
| 300 | G. E. sq. cg. | 360 |
| 300 | A. C. sl. rg. | 514 |
| 250 | G. E. Syn. | 600 |
| 200 | G. E. sl. rg. | 250 |

**ALTERNATORS**

| KVA | Type | RPM |
|---|---|---|
| 500 | El. Mchy. | 514 |
| 500 | G. E. | 225 |
| 375 | G. E. | 225 |
| 300 | Al. Ch. | 900 |
| 200 | G. E. | 600 |
| 187 | G. E. | 600 |
| 90 | G. E. | 900 |
| 60 | West. | 1200 |

**DIESEL-GEN.**
2—1250 Hp. Nordberg Westghse. generating units.

**M-G SETS**
2—720 KW West. to 1055 Hp. Syn. motors.
(Many others in all capacities.)

**DC MOTORS**

| Hp. | Type | RPM |
|---|---|---|
| 400 | Cr. Wh. | 230 v. 650 |
| 135 | G. E. | 230 v. 720 |
| 125 | G. E. | 230 v. 410 |
| 115 | G. E. | 115 v. 850 |

**TRANSFORMERS**
3—150 KVA Al. - Ch. 2300 v—480 v.
3—40 KVA G. E. 1100/2200—220/440.

**TURBO-GEN.**
1—300 KW G. E.-Curtis non-cond. AC.
1—300 KW Cr. Wh.-De Lav. 230 v. DC.

**ENGINE-GEN.**
1—150 Hp. Buckeye piston - valve D/C to 100 KW G. E. gen.

**Write for quotations—Large Stocks**
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440 Volt Used Motors. Complete with Control Equipment. In Good Condition.

1— 3 HP.—1735 RPM.
1—7½ HP.—1740 RPM.
1— 10 HP.— 860 RPM.
1— 15 HP.—1120 RPM.
1— 15 HP.—1150 RPM.
2— 25 HP.—1750 RPM.
1— 40 HP.— 900 RPM.

1—200 HP.—Variable speed complete with pulley and belt.

**Repossessed Eagle "Swintek" Screen Nozzle Ladders**

1— 8 in.—25 ft., used.
1—10 in.—50 ft., used.
1—10 in.—35 ft., new.

Also flexible hose couplings and fittings for 8 in. and 10 in. pipe line.

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**AC MOTORS**
50 HP. 900, 3/60/220 Fair.-Morse slip ring
75 HP. 900, 3/60/440 Gen. Elec. sqr. cage
100 HP. 900, 3/60/220 Allis-Chalmers sqr. cage
100 HP. 900, 3/60/2200 Fair.-Morse slip ring
100 HP. 720, 3/60/220 Westinghouse slip ring
200 HP. 600, 3/60/440 Elec. Machy. synchronous

**AC GENERATORS**
15 KW. 1800, 3/60/220 Roth dir. con. exciter
50 KVA. 1200, 3/60/2300 Bullock dir. con. exciter
240 KW. 720, 3/60/440 Gen. Elec. three bearing

**TRANSFORMERS**
3—100 KVA. Wagner 1/60 cy. 2300-230/460 Volt
3—250 KVA. Wagner 1/60 cy. 2200-220/440 Volt

**DIESEL GENERATOR**
47 KVA. 3/60/2400 V. Fair.-Morse Y style VA

**AIR COMPRESSORS**
92 CFM. Ingersoll-Rand class ER-1 7x6
327 CFM. Ingersoll-Rand 2 stage. 12 & 7½ x 12
599 CFM. Ingersoll-Rand 2 stage. 16 & 10 x 14

**CENTRIFUGAL PUMPS**
375 GPM. 30-lb. pressure. Advance belted type
1000 GPM. 170' head American 2 stage belted

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50' boom and $1,500 1-yd shovel attachment, absolutely A-1 condition, complete ..... **$4,000**

American 10-ton guy line derrick, 70' boom, 16' bull wheel, used very little ..... **$700**

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Shives and blocks slightly used, from 2" to 24", single wheel to 5 wheel, **½ price**

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**Electric Motors—All Sizes**

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4-ft. Symons Cone, Course Bowl, Tex-Rope. Drive to 100 H.P. Slip-Ring motor.

48-in. Symons Disc Crusher, Model 37 Marion.

Combination Steam Shovel and Crane with Fairleads for Dragline Service.

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27-E Koehring Paver, Gas., Cats., Boom and Bucket.

18—Direct heat, heavy duty, Rotary Dryers, 2-ft. by 10-ft. up to 7-ft. by 70-ft.

3—Large Jeffrey Hammer Mills, Ball Bearings.

3—Large American Ring Roll Mills.

9—Smaller Hammer Mills.

4—24-in. and 30-in. Steel Apron Conveyors.

**Many Other Bargains—All in Chicago Stock.**

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**3**—603 ft. I.R., POC-2 Diesel Air Compressors.
2 Ton 1000 Ft. Elec. Cableway.
Fuller Kinyon Portable Cement Unloader.
60 HP Portable Firebox Boiler.
60, 80, 180 and 360 HP Diesel Engines.
4—750 HP Busch Sulzer Diesel Units.
1½ yd., Cap. 60 ft. Span Bucket, OET Crane.
1¼ yd. Thew Steam Shovel.
1¼ yd. Marion 450 Electric Cat. Shovel.
8—3 yd. Koppel V, 36 ga. Dump Cars.
30—1½ yd., 36 ga. V Dump Cars.
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750-1250-1800 yd. Asphalt Plants.
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6 ft. by 8 ft. Traylor Tube Mill.
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Portable Air Compressors: 110-220 and 320 ft. cap.
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10 in. and 36 in. Superior McCully Crushers.
150 ton, 50 ft. RR Track Scale.
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3—100 HP 3 Drum Electric Hoists.
3—15 Ton 100' Boom Stiff-legged Derricks.
77-B Lorain 1½ yd. Diesel Shovel.
2—6 ft. 9 in. x 8 ft. Horizontal Batch Tumbling Mills.
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1730 ft. Bury 1927 Model Elec. Air Compressor.
1040 ft. Chgo. Pneu. Diesel Air Compressor.
676 ft. Worthington Duplex Elec. Air Compressor.
2 Marion 450 Diesel Shovels 1¼ yd.

**Hummer Vibrating Screens**

4—4x5 Single Frame, Double Deck.
2—4x5 Side by Side Double Deck.
1—4x5 Tandem (4x10) Single Deck.
1—4x6 Side by Side Double, Single Deck.
20—Vibrators V-16 and V-32.
2—7½ HP 3 P., 60 C., 220 V, 32V DC M.G. Sets.

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**2—3½ ton 36" ga. Plymouth Gas Locomotives.**
**12—5 yd. 36" ga. Western Dump Cars.**
**6—2 yd. 36" ga. Koppel Steel V-shape Cars.**
**4—1½ yd. 36" ga. Insley V-shape Dump Cars.**
**23—12 yd. Western 2-way Air or Hand Dump Cars.**
**4—50 ton 41 ft. Steel Flat Cars.**
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**2—40 ton Baldwin S.T. Locomotives, 14x22 cyls.**
**Rails—First-Class Relaying Rails, 60, 70, 80, 85, 90 and 100 Lb. Rails and Bars, Tie Plates, Spikes, Switches.**

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**CHICAGO, ILL. ST. LOUIS, MO.**

## FOR SALE OR RENT

2—36" gauge 7-ton Whitcomb Gas Locomotives.
1—36" gauge 12-ton Whitcomb Gas Locomotive.
1—Std. gauge 14-ton Porter Gas Locomotive.
1—Std. gauge 40-ton American Saddle Tank.
1—104 Northwest Crane.
1—Standard gauge Nordberg Track Shifter.
**Dump Cars, Locomotives, Shovels, Draglines.**

**CLAPP, RILEY & HALL EQUIPMENT CO.**
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## ROTARY KILNS SPECIAL

2—8'x125' P. & M. Rotary Kilns.
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3—8'6" and 9'6"x150' P. & M. Rotary Kilns.
1—6'x60' Rotary Kiln. At Martins Ferry, Ohio. Must be shipped within 15 days as premises have been rented.

4—Raymond High Side Roller Mills with air separation. One 3-roll. Two 5-roll **equipped with latest oil journals.**
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1—3'x20' Ruggles-Coles F-1 Rotary Dryer, complete. Single shell.
1—5'x30' Indirect Heat Rotary Dryer.
12—Rotary Dryers, 4'x30', 5x26, 5x30, 6x50, 6x60, 8'8"x85'.
5—Hardinge Iron Lined Ball Mills, 3'x8", 4½'x16", 6'x22". Also other sizes.
1—No. 32 Marcy Ball Mill.
1—4'x8' Kennedy steel lined Ball Mill.
2—24"x20" Jeffrey type "B" Hammer Mills.
1—36"x36" 4XC Gruendler Hammer Mill, roller bearings.
3—5'x22' Gates silex lined Tube Mills.
1—3'x12' Hendy Tube Mill, iron lined.
3—4'x5' Tyler Hummer Screens, No. 31 triple deck: 3—4'x7' No. 60 double deck: 3x5 and 4'x5' single deck. Also all other makes of vibrating screens.
2—Sturtevant Crushing Rolls 36x16, 20x14".
1—18"x36" McLanahan Single Roll Crusher, with Tex-rope drive and 25 H.P. Motor

**Just a Partial List**

SEND FOR BULLETIN of our regular stock of Crushers; Vibrating Screens; Ball, Rod and Tube Mills; Air Compressors; Rotary Kilns and Dryers; Hardinge Ball and Pebble Mills; Raymond and other Pulverizers; Air Classifiers; Thickeners; Wet Classifiers; Filter Presses; Continuous Filters, etc.

**CONSOLIDATED PRODUCTS COMPANY, INC.**

**17-19 Park Row New York, N. Y.**

Plant and Shops at Newark, N. J., cover 8 acres of ground.

## FOR SALE OR RENT

### 2 Koehring Dumptors

7-yd. steel dump bodies, caterpillar tracks, International motors, A-1 condition.

Price $1000 each.
Rental Price $3.00 per hour.
Located at Steubenville, Ohio.

**L. LEECH**
**923 Quinby Ave., Wooster, Ohio**

## FOR SALE

**Gyratory Crushers: No. 6, No. 5 and 10" Superior McCully, No. 5 Austin, No. 4 Style N, No. 3 and No. 2 Gates.**

**Symons Horizontal Disc Crushers: 48" and 24".**

**Jaw Crusher: 6x14, 8x16, 10x20, 16x24, 8x36, 11x36, 24x36.**

**Gas and Electric Motors: 1 HP to 200 HP.**

**Hoists: Clyde 2 drum for 2 yd. drag scraper, Thomas 2 drum for 1½ yd. drag scraper, several smaller.**

**Insley 5 ton all steel derrick, 80' boom, 90' mast, 2—55' guy struts, 16' bull wheel. 7x10 three drum hoist engine. 3x4 swing engine.**

**4 Complete gravel washing plants.**

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Business Cards 2x3½ (3 ply)...$2.50 $3.95 $ 7.35
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# BARGAINS IN HIGH GRADE REBUILT EQUIPMENT

### MOTORS
### 220/440 V., 60 Cy., 3 Ph.

| | |
|---|---|
| 1—250 Cr.-Wheeler Squirrel Cage | 1800 |
| 1—200 G.E. Squirrel Cage | 1800 |
| 1—150 G.E. Squirrel Cage | 1800 |
| 1—150 WEM CS Squirrel Cage | 1200 |
| 1—100 WEM CS Squirrel Cage | 1800 |
| 1—100 WEM CS Squirrel Cage | 1200 |
| 1— 75 Allis | 1800 |
| 2— 75 G.E. K.T. | 1200 |
| 1— 60 G.E. K.T. | 1800 |
| 1— 50 G.E. K.T. | 1800 |
| 2— 50 WEM CS | 1800 |
| 6— 50 G.E. K.T. | 900 |
| 1— 50 G.E. K.T. | 1200 |
| 2— 40 WEM CS | 1800 |
| 3— 40 G.E. K.T. | 680 |
| 4— 40 G.E. | 600 |
| 1— 75 WEM CS | 900 |

*Also, about 1000 other ratings, from ¼ H.P. up.*

### 2200 V., 60 Cy., 3 Ph.

| | |
|---|---|
| 1—300 Allis Squirrel Cage | 900 |
| 3—200 WEM CS Squirrel Cage | 1800 |
| 1—200 Allis Squirrel Cage | 1800 |
| 2—300 G.E. Squirrel Cage | 1200 |
| 2—100 WEM CS Squirrel Cage | 1200 |
| 2— 75 G.E. M.T. Slip Ring | 600 |
| 3— 50 G.E. M.T. Slip Ring | 600 |
| 1— 50 G.E. M.T. Slip Ring | 900 |
| 1— 75 G.E. M.T. Slip Ring | 900 |
| 1—125 Allis Slip Ring | 435 |

### MOTORS
### 220/440 V., 60 Cy., 3 Ph.

| | |
|---|---|
| 1—200 WEM CW | 500 |
| 2—250 WEM CW | 680 |
| 1—150 WEM CW | 585 |
| 1—100 G.E. M.T. | 900 |
| 1— 75 G.T. M.T. | 720 |
| 1— 75 WEM CW | 900 |
| 1— 75 G.E. M.T. | 900 |
| 1— 75 G.E. ITC | 900 |
| 1— 75 WEM CI | 870 |
| 2— 60 G.E. MTC | 900 |
| 1— 50 G.E. | 900 |

### TRANSFORMERS
### 60 Cy., 1 Ph., Oil Cooled

| | | | |
|---|---|---|---|
| (3) | 500 KVA | G. E. | 23000/2300/4000 |
| (3) | 300 " | Pittsburgh | 2300/230/460 |
| (3) | 300 " | G. E. | 6600/13200/2300/4000 |
| (3) | 150 " | WEM | 2300/230/460/115 |
| (3) | 250 " | G. E. | 2300/6600/230/460 |
| (3) | 200 " | G. E. | 2300/6600/230/460 |
| (3) | 75 " | G. E. | 11000/2300 new |
| (9) | 50 " | Packard | 2300/230/460 |
| (3) | 50 " | G. E. | 2300/230/460 |
| (2) | 50 " | WEM | 2200/4400/230/460 |
| (2) | 37½ | G. E. | 2200/4000/122/244 |
| (3) | 25 | G. E. | 2300/230/460 |
| (3) | 25 | Pittsburgh | 2300/115/230 |
| (3) | 25 | WEM | 2300/115/230 |
| (1) | 25 | WEM | 440/110/220 |
| (2) | 125 | Pittsburgh | 2300/230/460 |
| (4) | 5 | Allis | 440/110/220 |
| (4) | 10 | Wagner | 2300/230/460 |

Also many other ratings

### MOTOR GENERATOR SETS

(1)—300 KW GE 275/300 V DC 720 RPM 440 V. 60 Cy. 3 Ph. AC .8 PF complete with AC and DC panels.

(2)—Ridgeway Synchronous MG sets, 150 KW, 275 V. DC 2300/60/3 AC with AC and DC panels.

### Westinghouse Type SK Motors, 230 Volts.

| | | |
|---|---|---|
| 90—3 H.P. 1150 R.P.M | 2—10 H.P. 600 R.P.M. | 2—30 H.P. 1150 R.P.M. |
| 42—3 H.P. 1750 R.P.M. | 35—10 H.P. 850 R.P.M. | 1—30 H.P. 975 R.P.M. |
| 47—3½ H.P. 850 R.P.M. | 41—10 H.P. 1150 R.P.M. | 1—30 H.P. 775 R.P.M. |
| 162—5 H.P. 850 R.P.M. | 34—15 H.P. 1750 R.P.M. | 2—30 H.P. 850 R.P.M. |
| 76—5 H.P. 1150 R.P.M. | 17—15 H.P. 1150 R.P.M. | 14—40 H.P. 775 R.P.M. |
| 31—5 H.P. 1750 R.P.M. | 11—15 H.P. 1750 R.P.M. | 2—40 H.P. 1750 R.P.M. |
| 17—5 H.P. 3450 R.P.M. | 9—20 H.P. 850 R.P.M. | 3—40 H.P. 1150 R.P.M. |
| 28—7½ H.P. 1750 R.P.M. | 46—20 H.P. 1150 R.P.M. | 2—50 H.P. 680 R.P.M. |
| 78—7½ H.P. 1150 R.P.M. | 21—20 H.P. 1750 R.P.M. | 2—50 H.P. 225/350 R.P.M. |
| 65—7½ H.P. 850 R.P.M. | 6—25 H.P. 1150 R.P.M. | 3—50 H.P. 1150 R.P.M. |
| 1—10 H.P. 375 R.P.M. | 4—25 H.P. 850 R.P.M. | 5—60 H.P. 680 R.P.M. |
| 2—10 H.P. 300/1200 R.P.M. | 1—30 H.P. 1750 R.P.M. | 4—75 H.P. 1150 R.P.M. |
| | | 3—100 H.P. 1150 R.P.M. |

*Above is only a partial list. Other sizes and speeds available. If you don't see the size listed, send us your inquiry, as we may have something available.*

The above is only a partial list of equipment on hand. We have a large stock of transformers in various voltages—other M.G. Sets—Pumps—Industrial and Mine Hoists—Locomotives—Air Compressors, etc.

*All equipment thoroughly rebuilt in our own Shop and guaranteed.*

*Phone, write or wire your inquiries and send us lists of equipment you have for disposal.*

**PENN ELECTRICAL ENGINEERING CO. 517 Ash St. Scranton, Pa.**

---

## FOR SALE

30 Ton American 4-wheel saddle tank locomotive, 12x18 in. cylinders.

33 Ton Vulcan 4-wheel saddle tank locomotive, 13x18 in. cylinders, (Two duplicates).

36 Ton Porter 4-wheel saddle tank locomotives, 14x20 in. cylinders, (Two duplicates).

40 Ton Baldwin 4-wheel saddle tank locomotive, 14x22 in. cylinders, (Five duplicates).

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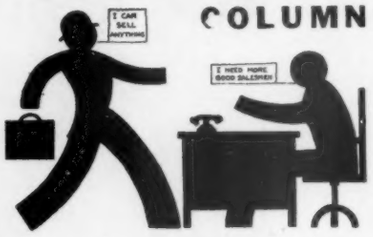


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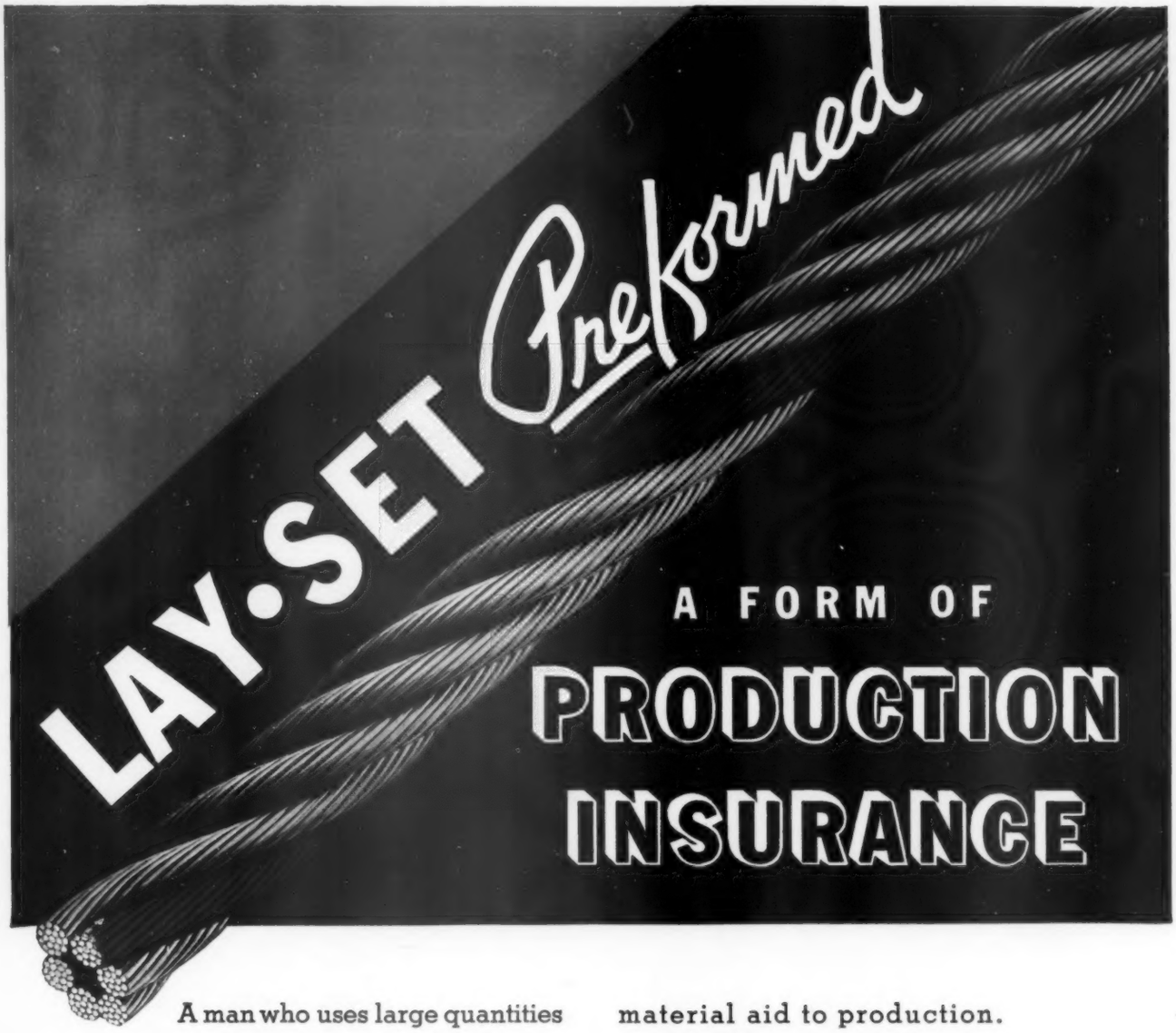
**INDIANAPOLIS, IND.**




A man who uses large quantities of wire rope tells us that he considers LAY-SET Preformed a fine form of insurance. He said that by its ability to last longer, and therefore reduce machine shut-downs, it proved itself a material aid to production.

LAY-SET costs a little more than non-preformed rope, but the slight difference in price is like an insurance premium which assures better production, greater economy and safety.

GREEN SIGNIFIES SAFETY

**HAZARD WIRE ROPE COMPANY**

Wilkes-Barre, Pennsylvania

An Associate Company of the American Chain Company, Inc.

*In Business for Your Safety*

*District Offices:* NEW YORK • CHICAGO • PHILADELPHIA • PITTSBURGH

BIRMINGHAM • DENVER • LOS ANGELES • TACOMA • FT. WORTH • SAN FRANCISCO

WE COMPLIMENT THE WESTERN RAILROADS ON THE SECOND ANNUAL RAILROAD WEEK — JULY 13-18

**LAY·SET Preformed Wire Rope**

ALL HAZARD WIRE ROPES MADE OF IMPROVED PLOW STEEL ARE IDENTIFIED BY THE GREEN STRAND

Lorain 87
• A new 2-yard shovel, convertible to Clam, Drag or Crane . . . and a new Big Capacity, Long Range Dragline, Clam, Crane . . . built to the proved Thew Center Drive design of simplicity, speed, power and endurance. The Thew Shovel Co., Lorain, Ohio.
THEW CENTER DRIVE
Lorain 95